ONTARIO FIELD CROPS
RESEARCH AND SERVICES COMMITTEE

2000 ANNUAL REPORT
TO

ONTARIO AGRICULTURAL SERVICES

COORDINATING COMMITTEE

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ONTARIO FIELD CROPS RESEARCH
AND SERVICES COMMITTEE
2000 Report

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Executive Summary

The Field Crop sector is a dynamic industry that continues to evolve and change. Cropping patterns are changing in demand to economic pressures, new technologies are being introduced and adopted rapidly and the producer (industry) is shifting more focus to consumers as their primary customers.

The Ontario Field Crops Research & Services Committee and it's six constituent subcommittees' role, set against that background of change, is to recommend strategic research and service directions to improve the efficiency of crop production in Ontario and to improve the competitiveness of, and opportunities for, Ontario agriculture in world markets. The major role that industry plays on these committees is essential in this process.

The 2000 Report continues to emphasize what FCRSC considers it's "core" research and service direction. These are in order of priority:

Research

- $ Crop Breeding and Biotechnology
- $ Agronomic Technologies
- $ Plant and Crop Physiology
- $ Variety/Pesticide Testing

Service

- $ Research Verification

These core areas are detailed in the section on Strategic Directions where current research/service activities are chronicled. These recommendations represent the areas of research and technology transfer that FCRSC considers essential to the strengthening of the field crop industry in Ontario. Within each core area are commodity and pest management specific priorities. Activity is documented in each area, and rate of progress, industry needs and potential for success should dictate the shifting of resources within and across these priorities. As directed by OASCC the four core strategic directions are listed in priority. Within each core direction, less emphasis should be placed on the listed order.

Introduction

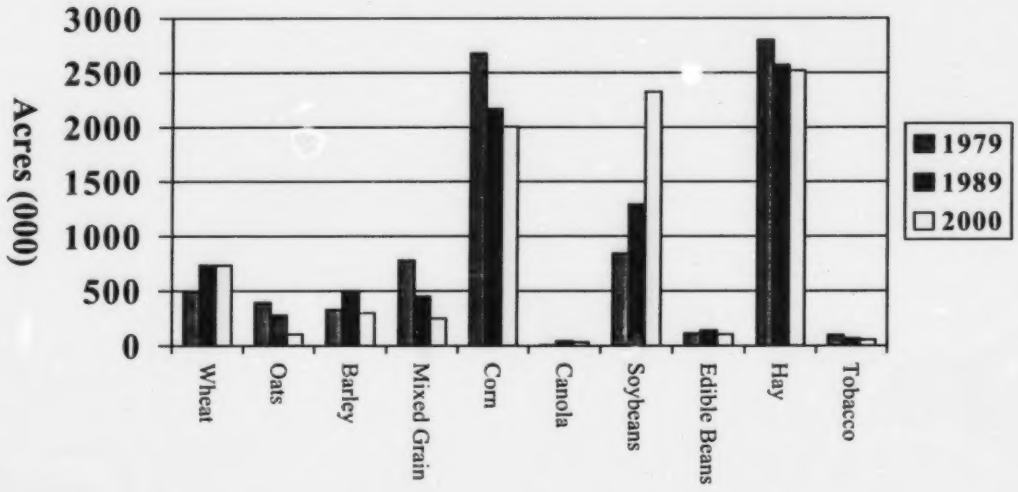
The 2000 Report of the Ontario Field Crops Research and Services Committee provides an overview of the status of field crop sector in Ontario including the identification of current issues facing the industry and the strategic directions and priorities for research and service.

As the Field Crop sector moves into the next millennium there are three prominent issues facing the industry: These are low commodity prices, safety nets and biotechnology. The Field Crop sector is currently facing unprecedented low prices across most commodities. A strong research program and an effective service program can help to mitigate the impact of these low prices, however an improvement in commodity pricing and improvement to the safety net support program will bring needed stability to the sector. Many producers had considerable difficulty in 2000, facing a very challenging year agronomically, coupled with another year of poor commodity prices.

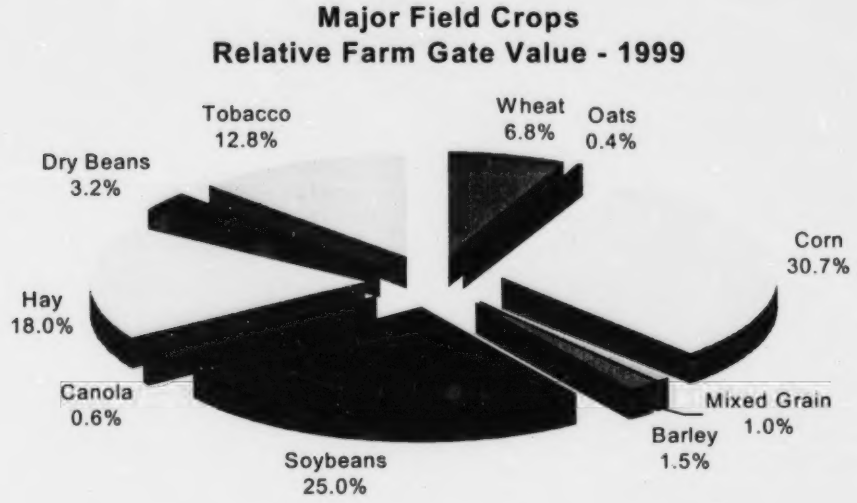
In addition, the slight uneasiness, previously noted with the products of biotechnology in the food chain, has not diminished and gained some notoriety in 2000 with the StarLink problem in the US. Further some export markets (Europe / Japan) continue with a number of restrictions on GM crops. This causes some uncertainty in the marketplace but also creates a number of Identity-Preserved (IP) opportunities that Ontario producers and the industry can capture. There is a strong desire to use the new technologies but with a concern over the ability to sell the crop and the choice of alternatives, some producers will shy away from these new products. In addition, although the primary GM products – Round-Up Ready Soybeans and Bt Corn - have been widely accepted as safe with no harm to the environment, consumer uneasiness driven by certain advocacy groups is causing some uncertainty. Most producer organizations support the technology as long as it is safe, does not harm the environment and provides additional opportunities and value for producers. The long-term benefit of this powerful set of technologies should not be jeopardized and the general public needs to be assured of food and environmental safety of each product.

Generally speaking in North America consumer response to foods produced through biotechnology is basically the same as for any other food. Taste, nutrition, price, safety and convenience are the major considerations (Thomas J. Hoban – North Carolina State University). Thus the goals of agricultural biotechnology in producing nutritious, safe and inexpensive food are very consistent with consumer demands. The education of consumers through a consistent message from producers, government, scientists and 3rd party groups (Medical associations) and the general trust in North America of food safety regulations and scientific rigor should ease the overall uncertainty. As a result opportunities for marketing products from modern biotechnology should expand tremendously. However, today the issue is still somewhat tenuous in North America.

Fig. 1 Field Crop Trends 1979-2000



Source: OMAFRA Statistics



The trends in the Field Crop sector over the last twenty years remain reasonably consistent. The major crops continue to be corn, soybeans, tobacco, hay and wheat (Fig. 1 & 2). Acreage and total farm gate value continues to decrease for barley, oats, and mixed grain. Acreage and value increased significantly for soybeans, although that has stabilized over the last 3-4 years. Wheat fluctuates based on price and winter kill. The overall 1998-00 acreage and production levels are shown in Table 1. Generally yield levels were not as good as in 1999, this was particularly so for corn and edible beans and to a lesser extent soybeans and tobacco. A late planting season in some areas of the province coupled with a poor growing season resulted in significantly reduced corn yields when compared to 1998 and 1999. In some instances the crop was so immature that it wasn't even harvested. This year was also unique in the occurrence of very high levels of leaf diseases (particularly rust) in corn and a wide proliferation of stalk quality problems. Quality was also a significant problem in many commodities. Notably even though wheat yields were quite high, about 50% of the crop had enough fusarium to downgrade it to feed wheat and this clearly impacted grower decisions as fall planted wheat was reduced to around 625,000 acres (~ 15% reduction). Somewhat unusual was the high incidence of fusarium in spring barley, particularly in west-central portions of Ontario. The quality of the edible bean crop was also challenging as result of poor harvesting conditions, test weight in corn was reduced, primarily in eastern Ontario and hay quality suffered from rain damage and delayed cutting.

Clearly, 2000 was a very difficult year in the field crop sector. However, there were also some bright spots as well.

Total Field Crop Value - $ 2.4 B
Source: OMAFRA Statistics

The identity-preserved market increased again in 2000. Although there were challenges in this area, there are also increasing opportunities. Soybeans tend to lead the way in this market with the production of specific tofu/natto varieties, special quality white hilum varieties, organic production and even non-GMO production. These opportunities are also increasing in other crops. As examples, premiums for cracker quality wheats, food-grade corn, and new coloured bean types have increased. In addition new markets are opening and expanding for our commodities, such as increasing industrial demand for corn (ethanol, citric acid). Adding to this optimism (perhaps uncertainty as well) are the changes undergoing in the role of various marketing boards and grower associations. New marketing opportunities in wheat and white beans are shaking the foundations of traditional marketing venues.

Table 1. Estimated Area, Production and Farm Value of Specified Field Crops, Ontario, 1998, 1999 and 2000.

			Area		Production		Farm Value	
Crop	Year	Units	June 1 (a)	For Harvest	Yield (units/ acre)	Total Unit ('000 units)	Per Unit ($)	Total ($'000)
			(acres)	(acres)				
Winter Wheat	1998	bu	710,000	710,000	62.7	44,500	3.24	144,200
	1999	bu	710,000	710,000	73.2	52,000	2.98	155,000
	2000	bu	680,000	680,000	74.3	50,500	..	..
Spring Wheat	1998	bu	90,000	90,000	41.1	3,700	3.47	12,830
	1999	bu	75,000	75,000	45.3	3,400	4.08	13,870
	2000	bu	85,000	82,000	46.3	3,800	..	..
Fall Rye	1998	bu	60,000	55,000	39.1	2,150	2.29	4,930
	1999	bu	70,000	60,000	41.7	2,500	1.90	4,750
	2000	bu	80,000	60,000	40.0	2,400	..	..
Buckwheat	1998	bu	5,000	4,500	33.3	150	7.29	1,094
	1999	bu	7,000	6,000	23.3	140	6.68	935
	2000	bu	7,000	5,000	26.0	130	..	..
Oats	1998	bu	110,000	100,000	61.0	6,100	1.91	11,650
	1999	bu	105,000	95,000	65.3	6,200	1.72	10,660
	2000	bu	90,000	70,000	61.4	4,300	..	..
Barley	1998	bu	325,000	310,000	56.5	17,500	2.35	41,200
	1999	bu	300,000	285,000	63.5	18,100	2.09	37,800
	2000	bu	250,000	230,000	57.4	13,200	..	..
Mixed Grain	1998	bu	290,000	280,000	60.7	17,000	1.86	31,700
	1999	bu	250,000	235,000	65.1	15,300	1.65	25,200
	2000	bu	200,000	175,000	66.3	11,600	..	..

Grain Corn	1998	bu	1,850,000	1,840,000	128.8	237,000	2.99	709,800
	1999	bu	1,825,000	1,800,000	128.3	231,000	2.84	656,000
	2000	bu	1,730,000	1,680,000	105.1	176,500	..	..
Canola	1998	bu	65,000	65,000	38.5	2,500	8.19	20,480
	1999	bu	75,000	70,000	34.3	2,400	6.06	14,540
	2000	bu	40,000	38,000	36.3	1,380	..	..
Soybeans	1998	bu	2,100,000	2,100,000	41.0	86,000	7.58	652,000
	1999	bu	2,125,000	2,125,000	40.5	86,000	7.17	617,000
	2000	bu	2,250,000	2,235,000	38.0	85,000	..	..
Dry White Beans	1998	cwt	35,000	35,000	16.0	560	29.29	16,400
	1999	cwt	85,000	85,000	17.4	1,480	25.52	37,770
	2000	cwt	55,000	53,000	13.3	705	..	..
Coloured Beans	1998	cwt	40,000	40,000	17.5	700	..	..
	1999	cwt	50,000	50,000	17.0	850	..	..
	2000	cwt	50,000	46,000	11.5	530	..	..
Fodder Corn	1998	tons	300,000	300,000	13.0	3,900	23.49	91,600
	1999	tons	300,000	300,000	15.3	4,600	22.00	101,200
	2000	tons	320,000	318,000	12.3	3,900	..	..
Hay (b)	1998	tons	2,325,000	2,265,000	2.1	47,009	8.06	460,900
	1999	tons	2,300,000	2,190,000	2.3	51,008	7.13	444,350
	2000	tons	2,300,000	2,240,000	2.4	5,400	..	..
Tobacco, flue-cured	1998	lbs	65,500	65,500	2,298.9	150,576	2.17	326,525
	1999	lbs	59,500	59,500	2,392.9	142,379	2.17	308,933
	2000	lbs	..	..	..	..	..	..

Source: OMAFRA Statistics

The total farm cash receipts in 1999 for Canada was approximately $ 30.46 billion across all sectors. Ontario's share of those cash receipts was 23.6% or 7.2 billion. The farm cash receipts of the Field Crop sector in Ontario are approximately $ 2.4 billion. This is in comparison to dairy at $ 1.30 billion, other livestock at 2.4 billion, all commercial fruit crops of approximately $ 0.23 billion, vegetables (including potatoes) at $ 0.31 billion , mushrooms at $ 0.11 billion and greenhouse crops of $ 0.24 billion.

Ontario field crops are a source of major exports, with approximately 75% of the white bean crop, 15% of the soybean crop and 12% of the corn crop being exported annually. In order to maintain the viability of agriculture in Ontario, the efficiency of production, the quality, safety and marketability of all field crops need to continually improve, both to enhance domestic markets and to compete globally. These are the primary goals of agricultural research.

Mandate of Field Crops Research and Services Committee:

The Ontario Field Crops Research and Services Committee and its constituent subcommittees are empowered to review and direct research and services leading to the improvement in crop production efficiencies and competitiveness of Ontario agriculture in world markets. Specifically the mandate of the committee is:

(a) To review reports submitted by Commodity and Pest Management-based subcommittees.

(b) To assess requirements for Field Crop Research and Services

(c) To establish priorities for Field Crop Research and Service programs

(d) To assess progress in Field Crop Research

(e) To develop and present reports and recommendations to the Ontario Agricultural Services Coordinating Committee describing the needs for Field Crop Research and Services including as appropriate information in relation to:

(i) cost-benefit
(ii) research facilities and personnel required
(iii) location best suited for the investigation
(iv) how funds might be obtained or freed to conduct new research or services
(v) operation of crop committees

(f) To consider and approve Chairs and membership of each Crop Committee

(g) To appoint representatives to other OASCC Research and Services Committees when requested and to liaise with the Ontario Pest Management Research and Services Committee.

(h) To provide an inventory of the research effort in field crops

(i) To take a lead role in the documentation of Research Accomplishments and Proposed New Research Directions for ARIO program reviews on a 4-year basis.

Industry/Sector Scan

Cereals

STATE OF THE INDUSTRY

Winter Cereals

A normal acreage (~ 735,000 acres) of winter wheat went into the winter in generally excellent conditions, with dry soils the only minor concern. Coupled with the third mild, low stress winter in a row, and an early, aggressive start to spring, the crop survived the winter very well, allowing almost all seeded acreage to go through to harvest.

Cool wet conditions in April caused a tremendous increase in soil borne and spindle streak virus outbreak, with some of the most severe cases ever seen in Ontario. Leaf diseases stayed at average levels throughout much of the vegetative growth of the wheat crop, often getting close to needing control but rarely reaching the threshold. Rust was a major concern after grain fill began.

FOLICUR was given emergency registration for winter wheat for the 2000 cropping season. Dr. Art Schaafsma at Ridgetown College set up a website to warn growers of potential risk. Interestingly, the majority of the wheat narrowly escaped what would be called epidemic outbreaks of fusarium infection with minimal rainfall during the critical flowering time period. However, extremely wet weather for two to three weeks after pollination allowed for secondary fusarium infection to develop at very high levels. Thus, again this year, a severe fusarium problem was evident at harvest. As the dust settles, 50% of the wheat crop will be used as feed, with only 600 to 700,000 tonnes of milling quality wheat harvested, barely enough to meet local demand.

Despite the fusarium outbreak, many producers had outstanding yields. The provincial average wheat yield is a record 75.5 bu/ac. The quality of the crop was problematic for the wheat board, with the incredibly low initial payment (29.00/t) on feed wheat having a real negative impact on producers financial situation. This negativism spilled over into planted acres in the fall of 2000.

However, a broadening of marketing options for wheat producers through the wheat board has helped the economic outlook greatly. In fact, marketed properly, wheat can be a growers most profitable crop. This bodes well for the future.

The outcome of the FOLICUR trials are also encouraging. Used at the correct time, this product could greatly add to our arsenal of management techniques to increase yield and quality in the wheat crop.

Premiums are also evolving for wheat of specific traits in the province. This has forced the Ontario Cereal Crop Committee to re-evaluate the registration process, and is also allowing for more profit potential for producers and the industry as a whole. The success of W.G. Thompson in securing the Kellogg's contract for breakfast cereals has opened potential for soft white wheat of excellent quality. The development of 25R26 as a cracker wheat for Nabisco mills in Toledo, Ohio, is another success story with profitable premiums attached.

Demand for Ontario wheat continues at record levels. It will be an ongoing challenge to have sufficient acreage to meet this demand.

The fall of 2000 saw a reduced acreage of wheat planted, both due to a late soybean harvest and producer disgruntlement. Estimates range from 600,000 to 650,000 acres. The crop went into the winter in better than expected condition, due to an excellent fall.

Winter barley acreage increased slightly again this year.

Spring Cereals:
Acreage was reduced across the board due to late planting. Early planted crop yielded well, but later plantings were disappointing.

Fusarium was a major issue in spring cereals. Barley was especially hard hit in west-central Ontario, as was wheat in the Ottawa valley. The spring cereals crop continues to be a weak sister in the cropping rotation of Ontario.

Accomplishments

Ontario Spring Wheat Action Plan

Accomplishment:
Assessment of the economics and production requirements of spring wheat were developed. The positive potential of this crop was then delivered to the Ontario producer at 4 meetings spread across the province.

> ***Why was this work undertaken? The usage of western Canadian hard red spring wheat for bread in this province continues to be well in excess of 1 million tonnes. The potential to replace a greater portion of this with Ontario spring wheat could benefit the entire Ontario industry. However, growers continue with the more traditional barley and mixed grain crops, despite better potential economics in spring wheat.***

Who did the work and how was it extended? This was an effort of the Ontario Wheat Producers Marketing Board, supported by industry and OMAFRA. Press releases, articles, along with extension meetings were used to extend the information.

Number of Benefactors: Producers, seed houses and millers can all benefit from this effort.

Dollar Impact: Estimating increased profit of $50.00/acre for producers over barley or mixed grain, an increase of spring wheat acreage of 100,000 acres could net producers an additional $5,000,000.00 annually.

Registration and Evaluation of Folicur

Accomplishment: Folicur was given emergency registration in time for application on the Ontario wheat crop.

Why was this work undertaken? Fusarium continues to be the number one concern in wheat production. The Fungicide Folicur, along with genetic tolerance, may allow for significant reduction in fusarium infections and related toxins. This product has been available in Europe and more recently in the U.S., but is not yet fully registered in Canada.

Who did the work? This was a co-operative effort between Bayer (sponsors of Folicur) and the disease pathologists across Canada. The Ontario component was spearheaded by Dr. Art Schaafsma of Ridgetown College, University of Guelph, supported by OMAFRA and industry. An alert website was developed, with ground truthing ongoing.

Number of Benefactors: The entire industry benefits

Dollar Impact: Variable, depending on the year. Has been as high as a $60 million dollar loss. In 2000, fusarium again had a major impact on growers, with estimates of 50 to 60% of the crop grading feed due to fusarium. On farm evaluation of folicur indicated a 1/3 reduction in fusarium damaged kernels. Work is ongoing.

Emerging Needs and Issues

$ The expanding market for wheat in Ontario is an incredible opportunity. The shift to a wide range of non-traditional breeds by the consumer has greatly broadened the adaptability and opportunity for non-pastry wheats in the province. Mills operating at 100% capacity indicate the demand that is available for our product.

Unfortunately, the impact of the environment, coupled with a limited varietal choice, put this market at peril. The failure of the industry standard, Fundulea, to meet milling specifications in 1998, has proven how tenuous this situation currently is. It is imperative that resources be placed in this area, of sufficient quantity and backing, if the industry truly wishes to maintain and expand this potential.

$ The on-going fusarium saga seems perpetual. It has become obvious that there is a grave need for the development of a reliable, objective measurement tool of fusarium contamination at the delivery point. Until we can accurately measure the disease reaction, it will be incredibly difficult to provide the Ontario producer with incentives to adopt innovative management technologies.

$ It is evident that some producers are driven primarily by net returns from individual crops, rather than following agronomically sound rotations. The value of these rotations needs to be investigated, particularly for soybeans, to make producers aware of the economic and soil health advantages of maintaining proper rotations. Also, some investigation of the disparity in wheat yields between areas of relatively equal corn and soybean yields needs to be undertaken, in order to increase wheat yields to economic levels in all areas.

- $ With no genetically modified wheat available in the marketplace, it has been simple for the industry to give assurances that products were indeed "non GMO". However, with a roundup ready spring feed wheat close to release in western Canada, this situation is about to change dramatically. The industry is now faced with determining how best to meet consumer demands, while allowing beneficial technological developments to occur throughout the industry.

Corn

State of the Industry

The 2000 crop year will result in the lowest average yield reported in the province since 1992. Poor weather during the planting period, particularly in the east resulted in delayed planting and lower yields. High levels of precipitation caused significant soil erosion in certain areas of the province and concerns over denitrification on heavy soils and nitrate leaching on coarse textured soils was widespread. Abnormally high levels of leaf diseases, most noticeably rust, were evident across much of the province. The yield losses caused by leaf rust, especially when it infected plants early (i.e. pre-silking) may have been underestimated. Poor stalk quality and a proliferation of stalk rots characterized much of this year's corn crop.

AAFC, Ottawa once again in 2000 conducted a survey of pests in Ontario and Quebec field corn in August and September. All of the OCC Performance Trial sites were evaluated for disease pressure.

Progress has been made within the research community (U. of Guelph, AAFC) in improving Ontario's opportunity to participate in the food grade corn industry. Work has moved forward on the identification and development of suitable hybrids, agronomic practices favouring grain quality, and drying and handling systems to meet food grade expectations.

A broad coalition of researchers continues to push towards the development of fusarium resistance for corn and techniques have been developed for testing the late season cold tolerance of corn hybrids.

Industrial demand for corn within the province continues to grow. Ethanol processing can be expected to expand with new plant construction at Cornwall, and further plant expansion at Chatham. The JBL citric acid plant is being built at Port Colborne. OCPA, OMAFRA and University of Guelph participated in research to identify opportunities for the manufacture of new industrial products, such as other organic acids, polyols, and plastic replacements.

*Ontario Crop Year - September 1 - August 31

YEAR*	AREA (ac) (Million)	YIELD (Bu/ac)	PRODUCTION (Bu)(Million)	$ VALUE (Million)
2000/01[1]	1.75	103	180	$531
1999/00	1.81	128.3	232	$638
1998/99	1.85	128.8	238	$702
1997/98	1.8	115	207	$800
1996/97	1.75	107.6	188	$838
1995/96	1.725	117.1	202	$929
1994/95	1.60	120.6	193	$619
1993/94	1.675	107.5	180.1	$602
1992/93	1.4	97	135.9	$371
1991/92	1.89	111	209	$558

[1]Forecast

Emerging Needs and Issues

$ **Corn production practices and their impact on water quality:** Increasing concerns over the impact of nitrogen and manure management on water quality will stimulate the setting of farm operation guidelines and necessitate further research.

$ **Corn research and service infrastructure.** Concern was expressed at the 2000 OCC meeting in November over the potential erosion of infrastructure within the corn research and service sector. In the case of performance testing, entry fees cover operating costs but do not come close to meeting the replacement costs of expensive plot combines.

$ **Identity preservation for corn**. Potential requirement for increased ability to segregate corn into identity preserve streams to supply both export and domestic demands.

$ **Rapidly increasing energy costs:** Field operations, grain drying, and synthetic N fertilizers will all be dramatically affected by rising petroleum costs. Research and adoption of lower energy input cropping systems will be increasingly more important and attractive.

- $ **Site Specific Nitrogen Management:** Although a nitrogen soil testing program for predicting N is available, it is not widely used, and its applicability to Ontario continues to be a topic of much debate. At the same time, environmental concerns with manure management increases the need for a reliable means of relating soil N levels to crop response and yield.

- $ **Crop Rotation/cover crop unrealized potential:** Water quality concerns, nutrient management requirements, costs of N fertilizer etc., should force a re-examination of the potential for cover crops within Ontario corn cropping systems

- $ **Evaluating Corn Hybrids for Silage:** Increased interest in using corn silage as the basis of forage programs on beef and dairy farms and the introduction of silage specific hybrids has raised the issue of how to rank corn hybrids for silage suitability. No standard set of protocols exists for conducting corn silage hybrid trials, or for carrying out quality measures. More recent research results indicate that the traditional method of drying and grinding silage samples for in-vitro analysis may, in some cases, overestimate animal performance

Forages

State of the Industry

Forage crops remain an essential component of Ontario's agriculture. They are grown on 65% of the farms in the province and cover 36% of the land being farmed. They continue to be the foundation of the dairy, beef, sheep, goat, horse, rabbit and game farming industries located throughout the province as they supply 60% to 85% of the nutrients fed to those animals. Forages allow Ontario farmers to produce milk and meat at a relatively low cost and in turn provide consumers with a plentiful supply of food at a price that reflects that cost. The forage industry and the industries that are dependent on them greatly contribute to the wealth of Ontario. The equine industry alone generates more than $ 4 billion annually.

Forages are grown for conserved feed on 2.52 million acres. Most forages are used on the farm where they are grown. In 1996 the value of the hay used on home farms was estimated to be $558 million. Hay sales generated another $5.5 million. Ontario hay has a reputation around the world of being a high quality product.

Hay supplies in Ontario at the end of the 2000 season are generally good to excellent in terms of quantity but quality is a concern in most areas. Winter survival of forages over the 1999/2000 winter was good in almost all areas of the province. The growing season of 2000 was excessively wet in June in most areas, reducing the quality of hay due to rain damage and delayed cutting. While cash prices are hard to determine, it appears that hay prices are relatively low for average and lower quality hay, but horse or dairy quality hay prices are strong.

Pastures are grown on 2.5 million acres and are found on 40% of the farms in Ontario. One third of the acreage is improved pasture. The conservative estimated dollar value of the feed from pasture in 1996 was $225 million dollars. There continues to be a strong interest in using better pasture management methods, particularly in the area of fall and winter grazing. Strong prices for calves

and yearlings has revitalized the beef industry, which should be reflected in more cattle and more pasture improvements in the next 2 to 3 years. In addition, numbers of sheep and lambs are up over 1999, which should again boost pasture usage.

Alfalfa based mixtures continue to be the principle choice for stored feed production. Timothy remains the main grass used with alfalfa but producers have continued to expand their use of other grass species in order to improve feed quality and acceptability, seasonal yield distribution and stand winter hardiness. A broader range of legume and grass species are used in pastures. This is due to the diversity of growing conditions, management practices, production goals, and livestock preferences. Meadow bromegrass is a valuable but little known pasture species which has been included in OFCC testing and is now found on the performance listing. Red clover is the primary legume used for plowdown in cash crop rotations. Red clover, timothy and birdsfoot trefoil are the major seed crops Trefoil prices remain low to the grower, however timothy prices are stronger this year.

The past year has seen livestock manure management and water quality become a very significant issue for Ontario farmers. It is likely that forage crops will play a role in dealing with these issues through the establishment of grass buffer zones along waterways and by having grass fields available to utilize manure nitrogen efficiently.

The diversity of forage species that are used in the province allows farming to be a viable option on all but the very poorest classes of land. Forages therefore support the economic health of all of Ontario's rural communities. Forage crops are also important to Ontario because they protect and rejuvenate soils, improve wildlife habitat and increase the beauty of the province thereby making it a more attractive place to live or visit.

Emerging Needs and Issues

- One year ago, the OFCC began to consider how variety testing might function if prior merit assessment was not required for registration. In 2000, the committee has essentially accepted that prior merit testing will be eliminated by July, 2002. Thus, the OFCC is now planning for a voluntary forage variety performance testing system. A draft proposal is complete and is being circulated to the seed trade and to other stakeholder groups for comment. This proposal indicates that testing will be on a fee for service basis, with companies paying a fee for each variety entered at a given site. The number of sites will likely be decreased and the presentation of data will also change. The OFCC plans to have the new testing system in place for the 2001 seeding year.

- There has been interest expressed by committee members regarding the possibility of having forages enrolled in the market revenue plan. It is felt that the production of forages could be encouraged if this were the case. In addition, further refinements to the Crop Insurance program for forage crops is desired. A new pilot project is underway currently to attempt to improve the drought coverage but given the conditions in 2000, many producers are seeking insurance against excessive rainfall in addition to the traditional drought plan.

- The corn silage issue is an "industry" issue since the industry is pushing to have more recognition and work done on the crop. At the moment OFCC has principally left it in the hands of the OCC with offers of support.

- The production of consistent quality dry hay continues to be a problem in Ontario for both domestic consumption and export markets. From an equipment engineering point of view, equipment needs to be developed to get the product harvested. Better systems need to be worked out to get around the weather problems prevalent across Ontario. The ensuing problem of marketing cash crop hay continues. Logistics and grading affect both buyer and seller. As a cash crop the dollar value in rotation is not well described in its affect on other crops in the rotation.

- There are a number of issues in the dairy sector that affect the feeding of forages. The need for low potassium in grass hay for dry cows is a broad issue. Grass hay needs to be of high quality, but low in potassium through both environmental influences and through genetic selection of forage grass species. A second feeding concern is low fibre levels associated with poor growing conditions and the subsequent problems balancing the rations. There is also a need for a high yielding grass species that is compatible with alfalfa. Pasture research is primarily an issue of the beef industry, but also tends to be local and specific to the situation.

- There are a couple of more distant emerging issues that should be noted. Perhaps the issue of sequestering carbon in soil via forage crops is an emerging issue, but it is so early in the process that only a very few farmers are aware of it. The bio tech debate as an emerging issue for forages is a few years away, however, now is the time to start addressing the problems of public acceptance.

Oilseeds

State of the Industry

$ Ontario soybean acreage has stabilized at around 2.25 million acres. The introduction of new, early maturing varieties continues to move the borders of short season production areas.

$ Grower enthusiasm remains high despite low prices. Competing crop prices are also at all-time lows.

Why?

- lower production costs than corn
- yields continue to improve
- expanding markets
- year to year yield stability

$ The rapid expansion of soybean acres in the last decade has not come without cost. Short rotations lead to a decline in soil structure and an increase in soil borne diseases. The introduction of new disease resistant or tolerant varieties does not mask the need for better and longer rotations in significant areas of the province.

$ More genetically enhanced beans hit the marketplace each year. Roundup ready (R.R.) is the thrust today but is just the tip of the iceberg. The acceptance of genetically enhanced beans is a roller-coaster ride with considerable uncertainty.

- $ There is an increasing demand for identity preserved (I.P.) and contract production in the food grade and non-G.E.O. marketplace. The Asian market currently represents about 45% of our total soybean exports, with Western Europe accounting for 20% and the middle East another 25%. Total exports for 1999/2000 are close to 1.0 million metric tonnes.

- $ The new soybean variety registration process (modified one year proposal) is currently on line for changes. This process should ensure producers quicker access to new varieties and technology.

- $ The need for a strong performance testing system for Ontario soybean varieties continues to be emphasized by the whole industry.

- $ Close to 70 thousand acres of spring canola with an estimated harvest of 60 thousand tonnes of good quality.

- $ Short season soys continue to move into the southern canola growing area.

- $ The industry is experimenting with some fall seeded spring canola (coated seed).

- $ 60 % of spring canola acres were genetically enhanced this year. A.D.M. and CanAmera are selling canola oil and as such are not concerned about G.E. canola.

- $ Hyola 401 seed is in tight supply, as it is in demand for non-G.E. markets in other countries.

- $ Winter canola acreage in Ontario is presently limited to approximately 1000 acres. This segment of the industry is precariously waiting for new disease resistant, winter hardy varieties. Considerable potential if and when that happens.

SIGNIFICANT RESEARCH/SERVICES ACCOMPLISHMENTS

Biotechnology – the introduction and early implications.

Accomplishments: Herbicide tolerant varieties have been introduced across all maturity ranges for Ontario growers. Advantages at this point are consistent weed control with low impact products. The promise of "what's to come" will bring the real impact to producer, processor and ultimately the consumer. The ongoing identification of marker genes in the soybean genome continues to make science even more precise.

Who: Biotechnology is driving many of the research programs in Ontario. In agriculture the work of soybean breeders and gene jockeys is just beginning to show with the introduction of this first generation of genetically enhanced varieties.

The Soybean Growers Marketing Board and the Canadian Soybean Export Association are investigating concerns by export buyers and consensus about the safety of bio engineered foods. Working with industry they are presently developing suitable solutions to all concerned parties. A new dimension has been added to agriculture.

New Soybean Cyst Nematode (SCN) resistant varieties for Ontario growers:

Accomplishments: The introduction of new high yielding soybean SCN resistant varieties across a broader maturity range gives growers a vital tool in managing this potentially devastating soil borne disease.

Why: SCN is found in a steadily expanding area. It is now well established throughout much of southwestern Ontario.

Who: Soybean breeders, both private and public, have developed a bigger and stronger arsenal for Ontario growers. Extension efforts put the rotation package together for successful management of SCN.

Benefits: The whole industry ultimately but none benefit more than growers hampered by the disease.

Dollar Impact: Conservative estimates place the loss to Ontario growers at $30 M/year.

Pulse Crops

State of the Industry

White Pea Beans

The 2000 crop year has been a difficult one. The current malaise affecting the grain markets of overproduction with low and unprofitable prices was all too evident in white pea beans. The 1999 crop year produced a record sized crop. An excellent growing season gave producers record to near record yields throughout North America (best in over 17 years for some regions). The lack of profitable cropping alternatives kept seeded acres in 2000 up in western North American growing regions. Total area planted to white beans in North America for the 2000 crop did not decline much. This is particularly true for regions outside of Ontario. Low prices and greater alternatives saw white bean acres in Michigan and Ontario decline. Ontario acreage declined to its second lowest level on record. A good portion of this acreage decline was the result of poor planting conditions (too dry early and then too wet late). The growing season was cool and wet. Burdensome supplies and low prices may discourage growers from expanding acres for the coming year. The following are the OBPMB best estimates for the 2000 crop year with 1999 figures in brackets. Acres harvested 53,000 (80,000); average yield 11.2 cwt./ac. (17.2 cwt./ac.); for total production of a commercial No. 1 bean - 595,000 cwt. (1,393,000 cwt.)

In an effort to encourage more white bean acres, the Ontario Bean Producers' Marketing Board is exploring greater grower marketing flexibility by expanding options to growers for the coming years. For the crop year 2001, growers will have the option of contracting all, part or none of their production outside the agency pooling system. The grower has maximum flexibility to sell his production to whomever he chooses (this includes out of province buyers). It is the grower's responsibility to do - due diligence - as to the financial worthiness of any buyer. In an effort to get

the best possible return to the pool, the Board is revamping the current marketing plan of the pooling system. This includes the elimination of the landed basis, reducing and reverting to a fixed handling or processing fee of $4.60/cwt (Canadian) and allowing the Poll to sell beans to any buyer.

Coloured Beans

The coloured bean harvest has finally wrapped up with some very late double and replanted coloured bean crops being harvested as late as Thanksgiving weekend with debatable success. The OCBGA successfully lobbied Crop Insurance late in June for an extension of the last planting date for coloured beans and several thousand acres were able to get planted that were previously held up due to wet spring field conditions and continuous flooding. Letters of support from all of Ontario's Bean Dealers and especially the efforts of Ferguson Bros., was instrumental in our efforts to extend the planting date to July 5th. Adding to the adverse conditions of 2000 was the presence of white mold in fields and producers were experiencing difficulty in ground applying Ronilan for the mold. The OCBGA and Rob Templeman of OMAFRA joined forces to successfully push through the emergency registration of aerial application of Ronilan. Previous to these attempts, BASF had been denied the registration of aerial application of this chemical. All data had been previously submitted by BASF and it seemed that an industry driven initiative was what was required to get action.

After a long struggle to nurse this year's coloured bean crop to harvest, producers were prepared for reduced yields and concerns of quality. The OCBGA meet with Crop Insurance to address these concerns and relayed the information to growers with a timely news release at harvest. The OCBGA has continued to work through Crop Insurance to assure that there was no delay in the setting of the floating price for crop insurance claims for the 2000 crop. Prompt reporting of data from the Ontario Bean Dealers enabled the announcement of the floating price on December 11th, just eleven days after the required November 30th sales date period. Good working relations between OCBGA and Ontario Bean dealers can be credited for this prompt reporting. Quality problems with this year's crop has alerted directors of the OCBGA to meet with crop Insurance on January 24th to discuss changes to the existing plan.

Generally speaking, coloured bean acreage has remained stable, largely due to favourable prices in comparison to other commodities. There will be a small 1999 final Market Revenue Payment for coloured beans but that will be the first time coloured beans has drawn a payment from that program. With a watchful eye to our neighbours in the west, OCBGA expects coloured bean acreage for 2001 to remain steady largely due to the fact that Ontario major varieties of Kidney and Cranberry Beans have become well known worldwide for their top quality (size being a major factor). Also, Ontario's philosophy of meeting end users needs as a priority is important in obtaining and developing those niche markets. Complimentary working relations between growers and dealers is a strength in Ontario.

Emerging Needs and Issues

To support a stable bean industry in Ontario, through diversification of market classes (i.e. black, pinto, great northern types) and search for new market/consumers in Latin America (by industry) and variety development for these market classes. Other coloured beans such as adzuki bean (small red), Kintoki (large red) and Otebo (large white) are new classes being grown in Ontario for the last few years and these classes may need more attention in variety improvement for better adaption in Ontario and disease resistance (i.e. Kintoki and Otebo are all highly susceptible to BCMV and anthracnose).

Emphasis on quality bean production in Ontario needs to be emphasized as bean production acres increase in the west (Manitoba). Pulse Canada has initiated to set quality standard for pulses including dry beans. Ontario can take the lead in dry beans for producing a quality product.

There needs to be an update of the registration system for coloured beans and continue the discussion with white bean registration. The changes made to the performance testing system were done to rationalize the number of testing locations and the costs of performance testing.

Anthracnose has been a problem the last couple of years in Ontario and Manitoba. The committee and industry need to be more attentive to prevent the incidence of out breaks by encouraging growers to treat seed and discourage the use of bin-run seed.

Tobacco

STATE OF THE INDUSTRY

YEAR	AREA (HA) (x1000)	PRODUCTION (KG)(million)	VALUE($) (million)
2000/01[1]	21	44	216
1999/00	23	65	320
1998/99	26	70	326
1997/98	26	68	342
1996/97	24	62	318
1995/96	25	66	317
1994/95	23	57	272
1993/64	29	79	311
1992/93	26	64	266
1991/92	26	69	295

1=Forecast

Crop production and crop value for the year 2000 is low compared to previous years.

Environmental abnormalities, fertility related problems and severe blue mold infestation were the major constraints to tobacco production. The Ontario flue-cured tobacco crop is grown on about 1000 farming units.

The tobacco industry recognizes the need to improve tobacco quality in order to compete in a global market and continues to take a proactive role in grower education. The industry in cooperation with OMAFRA will, during the winter of 2000/01, present the most recent research information on tobacco production to growers in a series of workshops and winter meetings.

Emerging Needs and Issues

Tobacco mosaic virus can cause sever loss to the tobacco crop. During the 2000 crop season, disease incidence specific to U.S. cultivars were noted in the tobacco production area. There is an urgent need to develop practices to eradicate the disease spread in Ontario.

The tobacco industry is totally dependent on soil fumigation to control plant parasitic nematodes and the disease black root rot. Last year a new variety (CT681) resistant to black root rot was made available to tobacco farmers. This will reduce the use of the Chloropicrin (CP) containing fumigants in the farming system. A biological alternative to chemical fumigation for nematode control would also be of great value to farmers.

Varieties with less propensity to produce ABe grades are essential for the continued improvement in the marketability of Canadian tobacco. Bruising of tobacco continues to be a problem.

Blue mould, caused by *Peronospora tabacina*, can be a significant source of crop loss. In 1998, crop loss amounted for up to 10 million dollars. Similarly, crop loss due to blue mold during the 2000 growing season amounted to $11 million. Research is necessary to develop means of controlling this disease.

SIGNIFICANT RESEARCH ACCOMPLISHMENT

Tobacco Breeding and Genetics

Three new varieties, CT681, CT166 and CT157 were released to the farming community during 2000 growing season. The adoption rate of CT157 (13% of the total crop) was much higher than the other two cultivars which only formed 4% and <1% of the total crop. Survey results suggest that the quality characteristic of CT157 are superior to the check cultivars. Results based on two years data averaged over eight locations indicate that the newly registered cultivars (CT681 and CT166) are higher in yield and grade index compared to the standard checks (Delgold and Delfield). CT681 matures two days later and CT166 matures two days earlier than the checks. In addition to the superior yield and quality, CT681 offers the resistance to black root rot disease. Economic returns for CT681 and CT166 are 12% and 6% higher than the average of the check cultivars respectively.

Pest Management

Emerging Needs and Issues

Herbicide tolerant crops are having many different effects. It is felt they will have an impact on the way weeds will be managed (less residual, thresholds etc…). There is also an impact on the value of the herbicide market, which will drive some players out. The immediate benefit may be a reduction in the weed control cost for growers, but it the long term, this may prevent the introduction of new herbicides, while at the same time encourage the development of resistant weeds.

Company mergers are still occurring (Aventis, BASF, Syngenta). This, may have an effect on the number of people employed in the industry. A possible impact on the number of herbicides being offered is also possible and this may affect minor use labels.

In general, there is a perception the value of agriculture is low compared to the pharmaceutical industry. This will impact the introduction of new herbicides, as returns on investments may not reach threshold values.

It is felt that an increase in field crops files in the minor use system is slowing the process.

Herbicide residual activity, especially following field crops is still a concern.

Problem weeds, that is those weeds that tend to show up under no-till systems are also requesting attention. There is a need from growers for current information on which treatments are best. However, treatment of these weeds constitute are off-label

The upcoming Supreme Court judgement on pesticide use ban by municipalities will be closely watched. Depending on the outcome, an impact on the agricultural community is highly possible.

Pest Management Research Priorities From OFCPMS-OFCRSC - 2000

I. High Priority

Fusarium in wheat and corn

Current status: Biotech in Ottawa, Winnipeg, Guelph and industry for wheat and corn varieties. Agronomy is under control – no need for new effort in this area. Problems with grain quality testing methods at elevators. Fungicides in wheat need work. Forecasting in wheat is moving into extension soon. Model is fairly solid.

Priorities: Maintain level of support to continue valuable work. Area that needs the most work – Genetic resistant or biotech varieties. Improved quality testing methods at elevator, molecular markers. For wheat need better fungicides and continued support for forecasting.

Soybean Cyst Nematode

Current status: Every year growers are still losing dollars. Resistant varieties are not immune to the pest when populations are extreme. Long term rotation plots are looking at rotation strategies. Resistance variety testing for race shifting. Threshold work to establish accurate thresholds. Molecular markers to determine the field populations that are in Ontario. Biocontrol agents are not high priority.

Priorities: Molecular markers for the races. Extension activity to get info out. Resistant varieties breeding.

White Mold

Current status: Most agronomic issues are understood. Genetic resistance is the priority. In edible beans – timing of application of Ronilan needs to be corrected and extension needs to get the word out on this.

Priorities: Genetics (non-GMO). Edible beans need to look ahead of fungicides.

Root Rots in Soybeans including Pythium, Phytophthora, Rhizoctonia

Current status: On the rise, possibly due to shorter rotations because of commodity prices and reduced tillage.

Priorities: Agronomy needs to be better understand. Genetic resistance and work into breeding programs. Increase effort on these diseases

European chafer

Current status: A new serious concern for both corn and wheat in lighter soils.

Priorities Chemical control options need to be found. Questions on biology and agronomics need to be answered

Corn Rootworm

Current status: – new biotech resistant hybrids are coming by 2003. A new variant resistant to crop rotation might be coming. Technology stewardship for transgenics needs to be supported . Other control options are there. Growers want genetic resistance work in case Bt is lost because of resistance. We have more rotation options than some of the states so we aren't sure of the level of risk if the variant is here.

Priorities: Public funds for product stewardship and sustainability. Is the variant an issue in the province?

ECB

Current status – Baseline work on Bt resistance being funding by industry.
Priorities – Education on refuge and refuge compliance

II. Medium Priority

Bean Leaf Beetle

Current Status: Concerned about bean pod mottle virus. The beetle is now overwintering here. Are trade barriers (BPMV) going to make this a high priority? BPMV is here in Ontario on the beetles but haven't been found it on plant tissues yet. Seed samples were taken this fall to see if the disease is there.
Priorities - We need to look at the reasons for presence.

Cereal Leaf Beetle

Look at biological control status (failing in Huron county).

Slugs on beans

Still a nagging problem on reduced tilled beans with no effective control.

Corn leaf diseases

Grey Leaf Spot (suspected in Ontario but not confirmed) Can be devastating as it is in US corn belt. Associated with reduced tillage. Need to monitor for presence.

Potato Leafhopper in edible beans

Current status – PLH is becoming a more frequent pest and is showing up earlier in the year. .
Priorities – Resistance, seed treatments and trap cropping work to control

Alfalfa Weevil

Current status Need newer survey done on biocontrol agents. Why aren't they controlling the weevil? Is it out of synch with host, hyperparatism, is the wasp too non specific?
Priorities - Check status of these biocontrol agents in Ontario

Lygus bugs in alfalfa and canola

Link with alfalfa weevil projects. Biological agents are effective but we don't want alfalfa being sprayed for alfalfa weevil because it will kill the biocontrol agents for lygus.

III. Low Priority

Soybean Aphids

This is a new pest in the states and has spread at an alarming rate. Was found in neighboring MI counties last year. We need to get an idea of the potential situation here in Ontario.

Cutworms

A nagging problem for some no-till corn producers. Need to develop grower friendly solutions like transgenic corn, seed treatments, agronomic practices (weed management). Graduate research project underway will address this.

Tarnish plant bug in edible beans

This keeps coming up as a priority, but funding for research by grower groups has not supported this problem. No action suggested unless grower groups support.

IV. Emerging Issues:

Powdery Mildew

It appears that more cultivars are susceptible to this disease and we recommend that the Ontario Cereal Committee emphasize powdery mildew reaction awareness to producers.

Flea Beetles in corn

Gaucho seed treatment is registered for seed corn so this problems becomes an extension issue for risk forecast and seed treatment application

Stalk Rots and Rust in corn

Fusarium is a continual problem with other stalk rots being only occasional. We will keep an eye on this. Although huge in 2000 these are problems that need to be addressed by the seed industry via host resistance

Corn Rust

Seed companies know that they need to take this seriously but not necessarily from public funding.

Strategic Directions: Research

The core research priorities for Field Crops have not changed from the 1998 report and are consistent with those approved by ARIO in 1998. The specific projects have shifted somewhat with areas of emphasis changing to meet industry demands. The strategic directions are listed in priority, but the relative importance of the individual commodity recommendations may not be absolute and the order listed should be interpreted solely as a rough guideline.

Recommendation 1

Issue/Direction: Field Crop Breeding and Biotechnology

Source: All sub-committees/Ontario Field Crop Research Coalition

OASCC Linkages: OPMRSC, OFPRSC

Target Agencies: ARIO, AAFC, CARC

This area of research activity reflects the primary strategic direction identified by FCRSC. It is a broad area encompassing all major field crops and a wide cross-section of goals from breeding of high-yielding well-adapted cultivars to basic science on molecular markers and transformation technologies. The objective is to develop and utilize tools of biotechnology and breeding to make significant genetic improvements manifested in effective/efficient technologies and superior germplasm/varieties/inbreds/hybrids. The priorities listed identify specific targets for genetic enhancement to improve yield potential, disease and pest resistance, winter survival, food and feed quality, new domestic and export markets. Activity is taking place within all of these areas with shifts as required. Specific details are provided as follows:

Research Priorities

1. Ontario Cereal Crops Committee, Ontario Pest Management Committee

Fusarium Head Blight Breeding and Research on Wheat, Barley and Other Crops

Background: The 1996 wheat crop was devastated by Fusarium to an extent never before experienced in Ontario. Fusarium outbreaks have also been significant across the Western provinces in recent years and again in Ontario in 2000. The food safety, quality and financial ramifications of these outbreaks are such that the whole industry could be destroyed. It is imperative than an integrated approach to controlling this disease is developed.

Fusarium head blight is a fungal pathogen that is not host specific. For instance, cereal crops may be inoculated by spores originating from corn stubble. Along with significant yield losses, the fungus produces vomitoxins which affect animal performance and make the grain unsuitable for human consumption. Fusarium is of most concern in wheat crops destined for milling into flour.

Breeding for resistance is underway and should continue with emphasis, but best possible scenario puts varieties 3 years away from seed supply for commercial producers. This time will be extended if initial attempts to incorporate resistance result in varieties with other agronomic shortfalls. Research is needed on the pathology of the disease, to seek opportunities for cultural control and methods to improve the resistance of affected cereal species. Research is also needed to further assess the potential impact of other management opportunities (tillage, pesticides, rotations, etc.)

There is also a great need to develop a repeatable test for resistance. The existing test for fusarium is not very robust, and results vary greatly within test locations, despite state of the art innoculation techniques. Some varieties show the best reaction in one location, and nearly the worst in another. Also, FHB indexes, typically used in information provided to growers, has limited correlation to Don levels, the true concern with a fusarium infected crop. Methods of analyzing both for research and industry are imperative, with some level of confidence in the repeatability of the test. There are serious problems with the grain grading system for fusarium in wheat. There is currently no real incentive for producers to adopt new technologies with the current grading system which functions somewhat arbitrarily.

Economic Importance: The impact of Fusarium on the 1996 wheat crop reduced farm income in excess of $120 million dollars. It cost the milling industry a further $30 million dollars to source and transport the wheat needed to replace the Ontario crop. There is some economic loss from fusarium in Ontario every year. In 2000, estimates of losses were placed at about $ 30 million.

Social Benefits: Control of this disease will ensure a safe supply of food products for all consumers in Ontario

2. Ontario Corn Committee

Cold Tolerance in Corn

Research on cold tolerance needs to be conducted at several levels. Develop reliable techniques to assess tolerance of corn hybrids/inbreds to chilling during grain filling, and determine if chilling tolerance during grain filling is correlated to early season cold tolerance.

Investigate genetic engineering opportunities to enhance plant defence mechanisms, modify chloroplast membrane composition, and/or modify carbohydrate levels under low temperature conditions, to improve resistance of corn to low temperatures during grain filling.

More information is required regarding the conditions that limit corn growth, germplasm that will prosper in cool conditions and the relationship to traits that provide superior hybrid performance under the warmer conditions that exist during the summer and the cooler conditions that exist during the fall.

Ultimately, the goal is to incorporate superior cold tolerance into superior lines in corn breeding programs. The proposed research would first focus on the development of repeatable techniques to quickly screen material for cold tolerance, both spring and fall. The second phase would be to characterize the variability in different sources of germplasm and the linkages among cold tolerance, general stress tolerance and final yield. Biotechnological methods could play a significant role in:

a) identifying QTL traits for cold tolerance, to facilitate its incorporation into breeding material; and

b) movement of cold tolerance from other species into corn for subsequent manipulation through more traditional breeding techniques.

Funding is required for support of postdoctoral fellows and graduate students.

3. Ontario Oil and Protein Seed Crop Committee

BREEDING FOR YIELD & STABILITY IN SOYBEANS

Details: The objective of this priority is to highlight the importance and benefits of a continued strong emphasis on breeding for yield potential and stability in soybeans. Soybean is an extremely important cash crop in Ontario with an economic farm gate value in excess of $500 million/year. Plant breeding results in significant increases in productivity and economic gain, without significant increases in production inputs. In Ontario, for each 1% gain in yield potential, farm gate value increases by over $5 million at current acreages (1.9 million), price ($7.50/bu) and yield (38 bu/ac).

Background: Soybean productivity in Ontario is increasing at approximately 1.5%/year due to improved cultivars and superior production techniques. At this rate of increase, the soybean crop will be worth $615 million (in farm gate receipts) at the end of a 10-yr period. This is a farm gate payback of $375 million! Maintaining the current rate of gain will require a greater contribution from plant breeding. The amount of emphasis that can be allocated to breeding for yield depends upon the number of other traits that must be considered. Breeding for resistance to soybean cyst nematode and white mould and breeding for specific end-uses, such as food quality for export markets (tofu, natto, soymilk, miso) and in value-added fatty acid profiles in the oil is also important to Ontario soybean production. Emphasis on breeding for other targets will pressure the gains that can be achieved in increasing the yield potential. Resources must be maintained or enhanced in breeding for yield to maintain the current rate of yield gain. With a reduction of just 0.5%/year the Ontario producers would lose more than $130 million over the next 10 years and using the 5:1 multiplier ratio, the entire soybean industry $650 million less.

4. Ontario Corn Committee, Ontario Pest Management Committee

Breeding for Natural Resistance to Corn Leaf Diseases and to European Corn Borer

In recent years there has been a substantial increase in the use of cultural practices that leave higher levels of crop residues on the soil surface throughout the winter and subsequent growing season. The presence of corn residues on or near the soil surface increase the risk and/or severity of infestation from European Corn Borer and infection from various fungal leaf diseases, such as eyespot, leaf blights and rust. In addition, leaf diseases not currently present in Ontario, and against which hybrids grown here carry little or no resistance, are threatening to move into this province from adjacent States in the USA.

Sources of genetic resistance to leaf diseases need to be identified and rapidly incorporated into superior inbred lines, using both traditional breeding methods and biotechnology. Success of this breeding effort and the prevention of devastating disease infestations will require the support of a plant pathologist with expertise in corn diseases. Currently, such a position does not exist in Canada. The Ontario Corn Committee recommends the creation of a full-time position for a corn pathologist at ECORC.

In the breeding programs at the University of Guelph and ECORC, there has been a decrease in the effort devoted to screening material for natural resistance to European Corn Borer. This reduction has resulted from both a decrease in funding and the development of hybrids with Bt- based protection. Because there is a risk that ECB may develop resistance to the Bt-based protection, the effort in screening for natural sources of resistance needs to be renewed to ensure continued protection for early season corn in Ontario. Funding is required for technical support at the University of Guelph and ECORC to support this work.

5. Ontario Oil and Protein Seed Crop Committee

BREEDING FOR NEW OR MODIFIED OIL AND PROTEIN TRAITS FOR SPECIFIC FOOD, FEED AND INDUSTRIAL USES IN AGRONOMICALLY ACCEPTABLE VARIETIES IN SOYBEANS

Details:

A. ***Oil modifications***:

B. Food Use

C. Increase palmitic and/or stearic acids (16-18%) to improve crystalline structure and use in solid fat applications

D. Reduce level of saturated fats (< 6%) to reduce negative health effects

E. Increase oleic (while lowering saturated and /or polyunsaturated fats to increase oxidate stability

2. Industrial Use

a) Increase linolenic acid (>55%) to replace linseed oil as a drying oil in the manufacture of paints and coatings

b) Add exotic fatty acids [recinoleic (>85%) and lauric acid (>50%)] to soybean to increase use in the manufacture of lubricating oil and other industrial products

B. ***Protein/Carbohydrate Modifications*:**

1. Food Use

a) Reduce content of fermentable carbohydrates to reduce intestinal discomfort and flatulence
b) Increase content of fermentable carbohydrates (sucrose, glucose, fructose) and increase the use of soybeans in the manufacture of soyfoods (miso, natto, tempeh)
c) Reduce lipoxygenase enzymes to reduce the beany or off-flavour
d) Reduce phenolics and flavonoids to reduce astringency and bitterness

2. **Feed Use**
a) Increase the content of soybean protein to increase value of soybean meal as a high protein feed supplement.
b) Increase content of essential amino acids (methionine and cysteine)
c) Increase lysine content to reduce the concentration of crude protein in the diets of poultry and swine
d) Reduce protease inhibitor activity by 80% to improve the digestion of proteins and reduce pancreatic hypertrophy
e) Reduce phytate to improve the availabilty of minerals protein solubility
f) Reduce goitrogens to reduce the risk of goiter

Background: Soybean oil and protein are used in the manufacture of human food, animal feed, and various industrial products. Soybean oil dominates the domestic and world vegetable oil markets. The oil contains saturated [palmitic (11%), stearic (4%)], monounsaturated [oleic (25%)], and ploy unsaturated [linoleic (50%), linolenic (9%)] fatty acids. Because of its fatty acid profile, the oil is used primarily as a salad and cooking oil and as a fat in the production of shortening and margarine. Only 2% of all soybean oil produced is used in industry. Specific genetic modifications can be made to improve oil content, quality and stability. These modifications can educe processing costs and increase the marketability and value ($.08 to $3 US /bushel) of soybeans (Iowa Agriculture & Home Economics Experiment Station Special Report 92)

Soybean protein constitutes about 46% of soybean meal and is used as an ingredient in animal feed, human food, and industrial products. About 95% of soybean meal is used to supply protein in livestock (poultry, swine, cattle) feeds. For use in food and products and industrial products, soybean meal is processed into various edible protein ingredients, including flour, concentrates, isolates. Most edible protein products are used to replace the use of animal and dairy proteins in foods for human consumption. Industry uses soybean protein primarily in the manufacture of paper coatings. Improving the content and quality of soybean protein can add $.06 to $.46 (US) to each bushel of soybean (Iowa Agriculture & Home Economics Experiment Station Special Report 92) and increase the nutrition, energy density, and marketability of soybean meal.

Soybean produced in Ontario must compete in the international marketplace with soybean and other oilseeds produced throughout the world. To maintain a share of the specialty oilseed market, each Ontario soybean variety must possess traits that provide added-value and a unique identity. Using current technologies (chemical mutagenesis, biotechnology, and breeding) oil and protein modifications can be made to add value and improve the marketability of soybean varieties developed in Ontario.

6. Ontario Cereal Crops Committee

Breeding and Identifying Wheats (all types) for Yield, Quality & Disease Resistance

Background: Genetic improvement of cereal crops has been of tremendous benefit to Ontario agriculture. Data from the Ontario wheat Producers' marketing board indicates a 58% yield increase over the 25 year time period from 1969 (1.085 t/ac.) to 1994 (1.715 t/ac.) from both genetic and management improvements. The obvious benefit from this work should continue.

New developments offer further potential to go beyond only yield improvements. The development and identification of varieties with more uniformity in kernel size, and non-pastry varieties with a greater proportion of high molecular weight proteins, could greatly improve the value of the crop to millers and bakers. This work should be intensified.

Pathologists also need to be involved in this endeavour, as disease parameters continue to have major impact on quality of the crop. An excellent example of this is the dwarf bunt situation of 1997. There is a tremendous shortfall of pathologists in our system.

Economic Importance: Each 1% increase in yield returns an additional 12,000 tonnes of wheat, or $2 million dollars in added revenue to the producer. Introduction of quality parameters could further enhance economic returns, estimated at 7 million dollars annually or more.

Competitiveness: Development of higher quality wheats could greatly enhance the competitive abilities of our millers and bakers with their counterparts in the U.S.

7. Ontario Forage Crops Committee

MANAGING CLIMATE-RELATED RISK IN PERENNIAL FORAGE CROPS:

I) Genetic/Biotechnology Improvements with respect to winter survival

II) Develop management techniques for improved winter survival of conventional and genetically altered alfalfa, and develop management techniques to enhance production of grasses during drought conditions.

Directed to: ARIO and AAFC

Background:

Perennial forages occupy more farmland than any other crop in Ontario. They provide the feed base for virtually all dairy, beef, sheep, goat, horse and ungulate farms. Although winterkill was of minor significance in most parts of Ontario last winter, producers are still concerned and fear another bad winter will result in a shortage of hay and higher prices. Since a secure supply of forage is critical to the operation of these industries, the OFCC feels that researchers have to concentrate more effort on methods to ensure that forage supply will be adequate.

Forage and livestock producers have stated quite clearly that climate related issues, especially winter-kill of alfalfa, are their number one concern. Genetic progress in alfalfa over the past 20 years has focussed on disease resistance, increased yields, and improved quality. However, specific efforts are required, by conventional or biotechnology means, to improve winter hardiness of alfalfa without deterring from other traits, especially yield, that have been improved in the past. To complement this work, improvements in the winter hardiness of orchard grass should be made, since this grass is increasing in use with alfalfa and is the key grass species used in sown pastures in much of the province.

In addition to genetic improvements, producers want management techniques that improve the continuity of forage supply over the growing season. This would include techniques in pasture management to even forage supply during spring and summer, cope with dry weather and extend the grazing season in the fall. For stored forages, efforts should be concentrated on ensuring that management techniques are properly matched with the needs of new genetic material introduced into the marketplace. When new traits are introduced to alfalfa or other species, the management package may need to be re-evaluated. In other cases, what is considered normal management may need to change to better ensure winter-survival of currently-used varieties.

The OFCC recommends that research be directed at ensuring the security and continuity of forage supply with respect to climate-related risk through improved genetics and management practices.

8. Ontario Corn Committee, Ontario Pest Management Committee

Resistance to Fusarium Ear Rot

Corn grown in Ontario continues to be prone, periodically, to severe infection by Fusarium ear rots. The toxins produced by these moulds seriously affect the performance and health of hogs, in particular, and may also affect the performance and/or health of other livestock, and humans. Livestock feeds still represent the greatest usage of corn in Ontario and the usage of corn for human consumption is increasing. Thus, high priority must continue to be given to the development of corn lines with resistance to Fusarium ear rots.

Initial work at ECORC and Ridgetown College, University of Guelph, have investigated the mechanisms of ear rot infection and identified sources of resistance. Continuing funding is needed, however, to assist with the incorporation of genes for resistance into breeding lines and then into commercial breeding material, using both conventional breeding methods and biotechnology.

9. Ontario Oil and Protein Seed Crop Committee

OPPORTUNITIES FOR BIOTECHNOLOGY IN ONTARIO SOYBEAN IMPROVEMENT

Details: Biotechnology and genomics research offers new opportunities for soybean crop improvement. Conventional breeding programs and the processing/distribution chain will increasingly rely on molecular markers for selection and cultivar identification. Genetic transformation will remain an important technology for the introduction of new traits and as a research tool. The following are priority areas for 2000-2001:

A. Molecular mapping, structural and functional genomics

a) mapping of qualitative and quantitative traits using DNA markers
b) determining gene function and identifying novel genes
c) linking biochemical functions of genes to phenotypic traits
d) determining the structure and organization of the soybean genome

B. Transformation

a) stable transformation of the soybean genome
b) transient expression systems
c) model plant systems for assessing the function of soybean genes

Background

A. *Molecular mapping, structural and functional genomics*

The current explosion of DNA sequence information coupled with recent advances in molecular-based technologies offer new opportunities for soybean improvement. Large, publically available databases of soybean DNA sequences, in the form of 'expressed sequence tags' (ESTs) and full length cDNA sequence, are new and powerful resources for identifying genes that determine traits. Presently, a limitation restricting the use of marker assisted selection in breeding programs is that the function of most genes and their relationship to agronomic traits remains unknown. There is also a need for more precise genetic maps with a greater density of DNA markers. Thus, it is a priority to develop high resolution genetic and physical maps of the soybean genome and to link genes to discrete functions and traits. Developing and maintaining recombinant inbred populations segregating for specific traits, and screening for germplasm diversity provide resources for gene discovery. Creating cDNA and genomic BAC (bacterial artificial chromosome) libraries, assembling sets of unique expressed genes, constructing gene microarrays, and undertaking large-scale automated sequencing of DNA represent important enabling technologies for gene identification.

B. *Transformation*

The introduction of genes that are not accessible by sexual means can be achieved by means of transformation. Transformation technology is also an important tool for determining gene function, and for linking genes to traits. Although there have been many advancements in plant transformation technologies, soybean transformation remains slow and inefficient. Soybean transformation procedures need to be improved for this to become a routine and easily applied technology.

Alternatives to stable transformation of soybean should also be developed, such as transient expression systems and viral vector expression systems. Legume 'model plants'(such as *Medicago truncatula* or *Lotus japonicus*) with efficient transformation methods, smaller genomes, and shorter generation times should also be further developed as systems for studying the function and organization of soybean genes.

10. Ontario Oil and Protein Seed Crop Committee, Ontario Pest Management Committee

BREEDING FOR RESISTANCE AND MANAGEMENT OF NEMATODES AND DISEASE IN SOYBEANS

Details: Oilseed crops in Ontario are subject to relatively few diseases; however, 4 or 5 require control to ensure sustainable consistent production. Chemical controls are environmentally and economically undesirable. The most effective way to control diseases of oilseeds and other field crops is through genetic resistance and effective management practices. The most important diseases of soybean in Ontario and estimated crop loss as a percentage of total production in 1994 are as follows: soybean cyst nematode (SCN) (0.80), Phytophthora root rot (PR) (0.50), Sclerotinia stem decay (SSD) (0.50), Rhizoctonia/Fusarium root rot (0.40) and pod and stem blight (PL) (0.20). These diseases accounted for approximately 65,250 tonnes in lost production or approximately $20 million. Although this loss is small compared to total production (2.9%), diseases can be devastating in certain areas and to individual growers.

Background: Control of SCN will require resistance/tolerance and effective management practices. Resistance to SCN is complex and difficult to identify but considerable success has been achieved in the USA where SCN has been a major problem for 30 years. Long-term crop rotation with nonhosts and resistant or tolerant varieties provides the most cost-effective control. As SCN spreads to additional counties in Ontario and races change, a continuous effort in breeding for resistance will be required to ensure high productivity.

Considerable success has been achieved in controlling PR by developing disease resistant cultivars. Resistance genes can be identified and incorporated into soybean varieties by relatively simple screening techniques. However, the development of new races necessitates the continuous development of new varieties with tolerance and monogenic resistance.

Sclerotinia stem rot is increasing in importance in Ontario and the north-central U.S.A. Varieties differ in tolerance to the disease but monogenic resistance has never been identified. This disease can cause severe losses but tends to occur sporadically. Crop rotation with nonhosts is recommended but once a field becomes infested with sclerotia (long term resting structures) the disease could reappear whenever conditions are favourable. Planting early varieties is effective in reducing disease severity and decreasing inoculum but growers are unlikely to accept an annual yield loss to control a sporadic disease. Full season, resistant/tolerant varieties and an effective management package could reduce the white mould problem.

Rhizoctonia/Fusarium root rot occurs in all soybean areas and soil types. Disease severity increases with plant stress caused by alternating wet and dry soil conditions. Most commercial varieties have at least moderate tolerance that was selected along with vigour and high yield.

12. Ontario Corn Committee

Development of Inbreds and Hybrids for Ontario

Many of the priorities for the corn industry depend upon successful incorporation of genetic traits, natural or modified, into superior breeding lines (e.g. pest resistance, food quality, feed quality, cold tolerance, stress tolerance, nitrogen efficiency, etc.). Thus, the corn breeding programs at the University of Guelph and ECORC are the vehicles by which material for study is identified and by which desirable traits are ultimately incorporated into hybrids used by the farmers of Ontario. Although there are large hybrid development programs in the private sector, hybrid development also must continue to be part of the public breeding programs, since it is only through locally adapted germplasm that the true value of genetic enhancements to corn growers can be properly evaluated. These public programs are important sources of such germplasm to be fed into the private sector corn development programs. Additionally, breeding and evaluation techniques need to be tested on an on-going basis to ensure that the most efficient techniques are being utilized. These public corn breeding, programs are also valuable training centres for new plant breeding students. Funding is required to provide increased technical support at both the University of Guelph and ECORC.

13. Ontario Pulse Crops Committee

Cultivar Development and Genetic Improvement of White and Coloured Beans
Directed to: ARIO, AAFC

Background: The objectives are cultivar release and germplasm improvement through intra- and inter-specific hybridization followed by conventional and biotechnology-aided selection methods.

1) Cultivar release with:
   -Improved yield potential with early to full season maturity and upright plant architype,
   -Cooking and canning quality acceptable for domestic and international trade,
   -Increased resistance to common and halo bacterial blight, white mold and root rot diseases,
   -Pyramiding resistance to anthracnose and bean common mosaic virus races prevalent in Ontario and other major genes controlling resistance to pests,
   -Transfer of resistance to potato leafhopper to dry beans adapted to Ontario.
   -Testing lines/cultivars in coop. trials to identify superior lines for registration and to generate performance data.

2) Application of biotechnology to improve efficiency in cultivar development through:
   -Identification of RAPD markers linked to common bacterial blight resistance genes aiding molecular marker assisted selection,
   -Integrating selection methods based on molecular estimates of genetic distance with conventional selection techniques to accelerate simultaneous improvement of yield, adaptation, quality and pest resistance,
   -Transfer of new genes (i.e. herbicide resistance) through transformation technique.

3) Germplasm improvement and utilization through:

-Multi-cycle intermatings of adapted and donor germplasm sources (within and between Meso-American and Andean races, and utilization of tepary bean and scarlet runner beans) to widen the germplasm base,
-Release of improved germplasm to breeders of private and public institutions.

14. Ontario Forage Crops Committee

IMPROVING FEEDING VALUE OF FORAGES FOR STORED FEED AND PASTURE:

I) Genetic/biotechnology improvements to energy content and/or other desirable quality traits.

II) Management of forage crops to optimize feeding potential.

Directed to: ARIO

Background:

High quality forage is the engine that drives the dairy industry in Ontario. Similarly, the beef and sheep industries rely to a great extent on high quality pasture and hay to ensure both milk production and proper rebreeding. Efforts to increase quality in both stored feed and pasture must be made to ensure that increased animal performance can be achieved from forages.

Alfalfa is the main stored forage used in Ontario. It supplies adequate amounts of crude protein when harvested at the correct stage of maturity, but is significantly lower in energy than grains such as corn or barley. Alfalfa that has been selected or genetically-modified to have higher digestible energy content would allow it to fill a higher proportion of the ration for milking cows and thus reduce feed costs. Progress has been made in the production and assessment of alfalfa varieties with reduced NDF levels and increase cell wall digestibility. Another area of interest would be to modify the types of protein found in common forage plants.

High quality forage harvested as pasture can be a very economical method to background beef cattle, develop beef and dairy breeding heifers, and grow market lambs. If these enterprises are to grow and prosper, more emphasis needs to be placed on managing the pasture resource to produce higher quality forage. Researchers need to focus on the forage quality requirements of the whole farm to integrate various methods and times of forage harvest into one complete system. Annual forage crops for stored feed or grazing should be considered here as well. The goal of the complete forage system should be to provide the maximum amount of nutrition from forages on a year round basis, supplementing with other feed sources only when the forage resource cannot provide those nutrients.

New species of forages need to be investigated for their ability to provide high quality forage in either pasture or stored feed systems. Before new types of alfalfa or other species are introduced to the marketplace, work should be done to ensure they can provide similar quality to existing material or else determine what management regime is needed to achieve the desired quality.

The OFCC recommends that research be directed at improving forage quality through genetic improvements, changes in management practices, or evaluation of new species.

15. Ontario Corn Committee

Quality of Food Grade Corn

Food grade quality corn represents a major value-added market for Ontario corn that has the potential to expand significantly. Currently, much of the market is being filled with corn or corn products from the U.S.A. Development of food grade quality corn suitable for production in Ontario represents a significant import-replacement opportunity, as well as an important export market (N.E. U.S. and throughout North America over the long term).

Research has begun within the University of Guelph, primarily at Ridgetown College, directed toward breeding early white, food grade corn inbreds and hybrids, suitable for production in Ontario and toward identifying yellow corn hybrids of food grade quality, in cooperation with the private sector.

Long-term funding is required to enhance the technical support for these programs and to ensure the continuation of this work.

16. Ontario Cereal Crops Committee

Priority 2C Cultivar Development and Genetic Improvement in Barley and Oats
Background: There are public breeding programs in barley at both Guelph and Ottawa. The public breeding of oats was rationalized in 1996 such that oat breeding would be done at ECORC (AAFC, Ottawa), with a testing program in central Ontario. The arrangement is that Quaker Oats provided funding which is matched by MII (AAFC's Matching Investment Initiative). The funds support a technical position located at Guelph, as well as part of the AAFC breeding program. An increased interest in hullless barley for the hog industry, and as an energy source for Northern Ontario, also needs to be assessed and evaluated.

Economic Importance: There were approximately 135,000 tonnes of barley produced in 1995, worth about $46 million, plus another 327,000 tonnes of mixed grain, worth $36 million. Production of sole crop oats was 85,000 tonnes, worth $11 million. In both crops, resistance to several diseases and races are being pyramided into new varieties so that resistance last longer after the new varieties are released. These crops are of special importance in the shorter growing season areas of Ontario.

Recommendation 2

Issue/Strategic Direction: Agronomic Technologies.

Source: All subcommittees / Ontario Field Crop Research Coalition

OASCC Linkages: OPMRSC, OSWARC

Target Agencies: ARIO, AAFC, CARC

Similar to recommendation # 1, this strategic direction includes all field crops important to Ontario Agriculture and covers a wide range of activities from tillage systems, nitrogen and nutrient-use efficiency, rotation, management systems, variable rate technology and others. The role of this research is to improve production efficiency leading to a reduction in per output unit costs ($/bu). The details provided identify current thrusts of this research. By nature, these projects tend to be more short-term than those of breeding and biotech.

1. Ontario Corn Committee

Nitrogen Use Efficiency in Corn

Nitrogen fertilizer represents a major input cost in corn production, is a significant component in many animal manures, and has the potential to adversely affect the quality of surface water and groundwater, if it is not managed appropriately. Continued research is needed to develop means to improve the utilization of nitrogen applied for corn production, as a means to reduce the amount applied while maintaining or increasing crop productivity. Variable-rate application must be one means of reducing nitrogen usage, but current techniques are inadequate for characterizing a field's nitrogen distribution and availability.

Characterizing a field using the soil nitrate test is inconvenient and expensive, because of the number of samples required to accurately describe the spatial and temporal variability in soil nitrate levels. A simpler, affordable alternative needs to be developed.

Preliminary work in the USA suggests the nitrogen status of corn leaves, early in the growing season, could be a useful indicator of overall crop nitrogen requirements. Research needs to be initiated to evaluate techniques for measuring crop nitrogen status under Ontario conditions. This must include an investigation of the effect of weather and soil variables on crop nitrogen uptake, growth and yield. In addition, the efficiency of N utilization of modern hybrids should be compared to hybrids of 15-20 years ago; to determine the accuracy for today's hybrids of N recommendations developed at that time.

Funding is required to provide additional technical support at the University of Guelph and ECORC.

2. Ontario Forage Crops Committee

IMPROVING FEEDING VALUE OF FORAGES FOR STORED FEED AND PASTURE:

I) Genetic/biotechnology improvements to energy content and/or other desirable quality traits.

II) Management of forage crops to optimize feeding potential.

Directed to: **ARIO**

Background:

High quality forage is the engine that drives the dairy industry in Ontario. Similarly, the beef and sheep industries rely to a great extent on high quality pasture and hay to ensure both milk production and proper rebreeding. Efforts to increase quality in both stored feed and pasture must be made to ensure that increased animal performance can be achieved from forages.

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High quality forage harvested as pasture can be a very economical method to background beef cattle, develop beef and dairy breeding heifers, and grow market lambs. If these enterprises are to grow and prosper, more emphasis needs to be placed on managing the pasture resource to produce higher quality forage. Researchers need to focus on the forage quality requirements of the whole farm to integrate various methods and times of forage harvest into one complete system. Annual forage crops for stored feed or grazing should be considered here as well. The goal of the complete forage system should be to provide the maximum amount of nutrition from forages on a year round basis, supplementing with other feed sources only when the forage resource cannot provide those nutrients.

New species of forages need to be investigated for their ability to provide high quality forage in either pasture or stored feed systems. Before new types of alfalfa or other species are introduced to the marketplace, work should be done to ensure they can provide similar quality to existing material or else determine what management regime is needed to achieve the desired quality.

The OFCC recommends that research be directed at improving forage quality through genetic improvements, changes in management practices, or evaluation of new species.

3. Ontario Cereal Crops Committee

Protein Content of Non-Pastry Wheats

Background: The protein content of non-pastry (a.k.a. milling, bread or hard red) wheats is critical to their end use and marketing.

Research on nitrogen management to increase the protein content of hard red winter wheat is underway. This is a co-operative project between OMAFRA, C & M Seeds, W. G. Thompson and Sons. U. of G. and Agriculture and Agri-Food Canada. Results have been inconsistent between sites. Generally, optimal growing conditions lead to high yields of lower protein wheat. Some sites have much more response w.r.t. protein with additional nitrogen application. These sites should be evaluated for parameters such as organic matter, rotation and manure inputs, to further predict optional locations for production of this wheat class. There are a very limited number of varieties available to growers that meet the needs of the industry.

Continuation of the research on nitrogen application to non-pastry winters is necessary to ensure that a larger percentage of the crop consistently meets the protein requirements without causing undue harm to the groundwater. Also, further work on the protein quality needs to be added to further enhance baking parameters beyond the agronomic practices.

Economic Importance: Premiums paid by the Ontario Wheat Producers' Marketing Board (OWPMB) encourage growers to produce hard red winter wheat with protein contents over 11.5%. These premiums range from $7/tonne for wheat at 11.5% protein to $18/tonne for wheat with protein over 12.5%. The OWPMB expects to market 90,000 tonnes of non-pastry winter wheat in 1996-97. Initial payment for non-pastry wheats are $25/tonne over those for pastry wheats and the markets are primarily domestic vs export for the non-pastry wheats.

Nitrogen prices are high. Excess N applied beyond the need of the crop reduces profit.

Environmental Benefits: Nitrate contamination of groundwater is a concern if farmers who are trying to achieve protein contents that pay premiums apply nitrogen in excess of crop requirements.

Social Benefits: Non-pastry wheats produced in Ontario displace those brought into the province by millers. Non-pastry wheats displace acreage of pastry wheats thereby shifting marketing from import/export volatility to self sufficiency/export.

Competitiveness: Returns to farmers are greater from non-pastry wheats than from pastry types and displace imports (primarily from the west).

4. Ontario Oil and Protein Seed Crop Committee

DEVELOPMENT OF AGRONOMIC PRACTICES THAT UTILIZE INNOVATIVE TECHNOLOGIES, ENHANCE SUSTAINABLE PRODUCTION, AND EXPLOIT THE YIELD POTENTIAL OF NEW CULTIVARS

Details: Significant improvements have been made in the yield potential of soybean varieties. This improvement has been made with little attention to changes in production practices. Research is required on production systems involving improved varieties. Environmental pressures are shifting production practices towards minimal application of herbicides, fertilizers, or pesticides. Reduced tillage could result in a 30-35% savings in land preparation costs and narrow rows may increase yields 5-10%.

Background: Over the past 15 years significant changes have occurred in Ontario soybean production practices. Four of the principal trends are as follows:

1. Increased acreage- The total soybean acreage planted has increased significantly over the past 15 years. This resulted from expansion of the soybean producing area in the north and east and reduced rotation in traditional growing areas.

2. Narrower rows- Soybeans were traditionally grown in 30 inch rows but the majority of soybeans within the province are now grown at a variety of row widths below 25 inches. Narrow rows affect the climate within the crop canopy and can have an effect on weed populations and foliar and root diseases.

3. Reduced tillage- Soybeans are readily adapted to a variety of tillage practices. The development of no-till seed drills has facilitated reduced tillage for soybeans especially in the shorter season areas of the province. Production difficulties have occurred with reduced tillage on fine textured soils. The causes of these difficulties have not been identified. Soil structure, soil moisture, and plant diseases may be factors.

4. Reduced rotation- Soybeans are included more frequently in crop rotations especially in southwestern Ontario. The effect of this practice on soil structure, fertility, weeds, and diseases requires additional research.

5. Ontario Weed Committee, All Crops Committee's

EVALUATE AND MONITOR THE ECOLOGICAL AND ENVIRONMENTAL IMPACT OF HERBICIDE TOLERANT CROPS, INCLUDING SHIFTS IN WEED POPULATIONS AND DEVELOPMENT OF HERBICIDE RESISTANT WEED BIOTYPES.

Determine **weed specific (biologically effective) herbicide rates** and critical factors affecting their performance. This information will help growers minimize herbicide use by adjusting the dose to the particular weed problem. It includes the effect of sub-lethal doses on weed seed production, viability and germination, and critical factors affecting product efficacy (e.g. water quality, field and weather conditions, addition of adjuvants such as veg oil, application in mixtures with N-fertilizer, time of day, soil fertility, variable rate application, etc.).

Develop management strategies for **problem weeds** (e.g. wild carrot, Canada fleabane, horsetail, swamp smartweed, etc.).

Develop and evaluate **site-specific methods** of weed management as a means of reducing weed control costs and/or improving efficiency by targeting only those areas of a field where weed problems occur (with a particular emphasis on no-till systems and perennial weeds).

Develop a comprehensive **herbicide resistance management** strategy to prevent and reduce herbicide resistance problems in Ontario, including guidelines on the use of tank-mixtures and rotation of herbicide groups.

Develop **integrated weed management (IWM)** systems for field crops

Evaluate effectiveness of **new herbicides**.

6. Ontario Weed Committee, Ontario Oil and Protein Seed Crop Committee

DEVELOP MANAGEMENT STRATEGIES FOR PROBLEM WEEDS IN REDUCED-TILLAGE SOYBEAN PRODUCTION SYSTEMS

Develop and evaluate **site-specific methods** of weed management as a means of reducing weed control costs and/or improving efficiency by targeting only those areas of a field where weed problems occur (with a particular emphasis on no-till systems and perennial weeds).

7. Ontario Cereal Crops Committee, Ontario Weed Committee, Ontario Pest Management Committee

Assessment of Rotation Benefits

Background: Many producers base cropping plans on maximizing the net return on every acre. In the past, this led to continuous corn. Currently, the trend to multi-year soybeans with occasional break crops is becoming evident, with the expected related problems just now with developing: soybean cyst nematode, potential new races of phytophthera, higher incidence of the rhizooctonia and pythium, etc.

While some data exists to value cereals in the rotation with corn (Vyn, Young), virtually no research is currently available to value cereals in the rotation with soybeans. This information is essential to maintain the productivity of our soils over the long term.

Also, herbicide carryover impacts on cereal crops, especially wheat, are constantly being discussed. The Ontario Weed Committee should further investigate these concerns.

Economic Importance: Yield loses to continuous monoculture may be as high as 20%. If 50% of the soybean acreage was affected even at a 10% level, economic returns to the producer could approach $50 million dollars annually.

Environmental and Social Benefits: All would benefit from the rotation opportunity of reduced herbicide inputs, other herbicide timing options, improved soil quality and reduced erosion.

Competitiveness: Competitiveness would be retained by maintaining high yields in each crop, and avoiding the pitfalls associated with monoculture.

8. Ontario Forage Crops Committee

Title: MANAGING CLIMATE-RELATED RISK IN PERENNIAL FORAGE CROPS:

I) Genetic/Biotechnology Improvements with respect to winter survival

II) Develop management techniques for improved winter survival of conventional and genetically altered alfalfa, and develop management techniques to enhance production of grasses during drought conditions.

Directed to: ARIO and AAFC

Background:
Perennial forages occupy more farmland than any other crop in Ontario. They provide the feed base for virtually all dairy, beef, sheep, goat, horse and ungulate farms. Although winterkill was of minor significance in most parts of Ontario last winter, producers are still concerned and fear another bad winter will result in a shortage of hay and higher prices. Since a secure supply of forage is critical to the operation of these industries, the OFCC feels that researchers have to concentrate more effort on methods to ensure that forage supply will be adequate.

Forage and livestock producers have stated quite clearly that climate related issues, especially winter-kill of alfalfa, are their number one concern. Genetic progress in alfalfa over the past 20 years has focussed on disease resistance, increased yields, and improved quality. However, specific efforts are required, by conventional or biotechnology means, to improve winterhardiness of alfalfa without deterring from other traits, especially yield, that have been improved in the past. To complement this work, improvements in the winterhardiness of orchardgrass should be made, since this grass is increasing in use with alfalfa and is the key grass species used in sown pastures in much of the province.

In addition to genetic improvements, producers want management techniques that improve the continuity of forage supply over the growing season. This would include techniques in pasture management to even forage supply during spring and summer, cope with dry weather and extend the grazing season in the fall. For stored forages, efforts should be concentrated on ensuring that management techniques are properly matched with the needs of new genetic material introduced

into the marketplace. When new traits are introduced to alfalfa or other species, the management package may need to be re-evaluated. In other cases, what is considered normal management may need to change to better ensure winter-survival of currently-used varieties.

The OFCC recommends that research be directed at ensuring the security and continuity of forage supply with respect to climate-related risk through improved genetics and management practices.

9. Ontario Pulse Crop Committee, Ontario Pest Management Committee

Directed to: ARIO, AAFC

The objectives are to increase yield and crop quality, to improve efficiency in pest management, and to increase net returns to the grower and/or decrease the cost of production through efficient production practices.

Evaluation of New Seed Treatments for Root Rot

This research was initiated in 1998, and the primary focus is to identify new seed treatment products that provide better visual control of root rot, and provide a significant yield increase, compared to control treatments. In 2000, several new seed treatments were tested. As well, the seed treatments were tested for the control of seed borne anthracnose, in a greenhouse study. In the field studies in 2000, emergence and root rot were quite variable within plots, which may have masked some of the benefits of seed treatments. Most seed treatments improved emergence compared with the checks. Environmental conditions produced water logged conditions for most of the growing season, which may have negated any early season benefits of seed treatments. Based on a limited data set, none of the seed treatments stood out as a top, consistent performer in testing in 2000.

Evaluation of New Seed Treatments for Leafhoppers

A combination of higher leafhopper pressure in recent years, and greater grower awareness of leafhopper damage has resulted in an increase in spraying to control leafhoppers in edible bean crops. Most growers that monitor their fields closely find that they spray as many as three times each crop year. It was felt that some of the new insecticide seed treatments may provide some residual control of leafhoppers, which would result a reduction in field spraying. Despite relatively low leafhopper populations in 2000, the initial data suggests that leafhopper nymph populations can be kept below an economic threshold for up to 6 weeks after planting. Cost of the seed treatments are less that 2 of the cost of one pass of field spraying.

The Timing of Various Desiccants on the Agronomics and Seed Quality of Coloured Beans

This research was prompted by interest from the Ontario Coloured Bean Growers Association. Coloured bean growers are finding it difficult to properly time the application of certain desiccants. They are concerned about yield losses from shrivelled and smaller seed size, and seed quality losses from discoloured seed. Research was initiated in the fall of 2000 on dark red kidney and cranberry beans. All of the registered desiccants were tested at various stages of crop maturity. Agronomic and seed colour measurements will be done throughout the winter of 2000/2001.

Results have not been summarized at this time.

10. Ontario Oil and Protein Seed Crop Committee

IMPROVE THE PRODUCTION EFFICIENCY OF CANOLA

Details: Improving the productivity of canola in Ontario requires research in the following areas:

1. Ontario growers need a program which identifies the best hybrids and varieties coming from Western Canada, Ontario, and other countries.

2. Agronomic studies to determine nutrient requirements, efficient tillage systems, cropping systems, and varietal response to no-till.

3. Controls to reduce damage from insects (flea beetles) and disease (Alternaria and white mould).

4. Increase winter hardiness of winter canola.

Background: The spring canola crop is worth $12 million per year in Ontario. The prospect of inexpensive , broad-spectrum weed control, higher yielding varieties, $400/tonne prices and an available market make this an attractive cash crop for the short-season areas of Ontario in which growers have few cash crop options. However, canola has had little agronomic research in Ontario. Studies designed to: i) determine the nutrient requirements of high yielding requirements hybrids, ii) test more efficient planting systems such as no-till and iii) varietal response to no-till, iv) develop methods of controlling damage from flea beetles and Sclerotinia. In 1996, herbicide-tolerant canola varieties were available, yet little Ontario research has been done on cropping systems. Some data suggests that a glufosinate-tolerant variety is very susceptible to Alternaria. This could cause major problems if this variety is grown in the presence of the disease of the disease. Research is also needed to pinpoint when canola should be sprayed to maximize weed control, and yet not miss late-emerging weeds.

There is also a major need to extend the winter hardiness of winter canola. This likely means incorporating transgenic characteristics. If the crop would survive across southern Ontario, it offers 30% higher yields than spring canola, overwinter erosion protection, a better distribution of seasonal workload for the growers, better canola quality, and harvesting in July.

11. Ontario Cereal Crops Committee

Tillage Systems, Planting Dates, Winter Wheat Survival

Background: Ontario farmers have adopted minimum tillage systems in attempting to preserve soil quality, reduce erosion and improve profitability. The effects of various tillage systems on the survival of winter wheat is not known. These tillage systems may also interact with planting date criteria. There is also concern over the validity of current planting date data, and this should be verified given the major economic impact potential.

Economic Importance: Reduced tillage systems require specialized equipment. If specific systems enhance or do not affect winter wheat survival, farmers can reduce the large cost of a trial and error approach. The cost of re-seeding to annual crops will be minimized. The prediction of winter wheat acreage made in the fall will be more accurate for the harvest year thereby allowing better forecasting of market situations. As the relationship of planting dates to this scenario becomes better understood, yield estimates can be further enhanced. Producers will also be better able to determine at what time to no longer seed wheat in the fall.

Environmental and Social Benefits: Some conservation tillage systems may have no effect or even enhance winter wheat survival. Demonstrating such will encourage adoption of these tillage systems.

Competitiveness: Reduced costs of production/crop insurance claims will put Ontario producers in a more competitive situation considering most of the winter wheat grown in the province is exported. Increased yields from proper planting dates will further enhance competitiveness.

12. Ontario Cereal Crops Committee

Cereal Management Including Row Width's, Seeding Rates, and Starter Fertilizers

Background: As other crops move towards narrow rows, producers are enthusiastic about the potential to use one planting tool for all crops. Logistics of this new system allow for 10" row spacing as the minimum. Some U.S. trials indicate the ability to reduce plant populations due to accuracy of seed placement with these systems. An evaluation of this technology is necessary.

The benefits of seed placed starter fertilizers have also been touted by industry and producers, and have been proven in other crops. However, the impact of this on cereals, along with the relationship of soil test levels to this practice, has not been determined. This evaluation should be conducted.

Economic Importance: Seeding rate reductions of 33% may be possible. This equates to a potential $10 million dollar savings to the grower. Yield increases of 4 bu./ac. may be possible with seed placed starter fertilizer. This opportunity could yield $14 million dollars for Ontario's producers.

13. Ontario Cereal Crops Committee

Cereal Nutrition Including Sulphur, Copper, Chlorine, and Nitrogen Effects on Yield, Protein Content, Quality and Diseases

Background: Quality and disease incidence must be studied as they apply to cereal nutrition in addition to the nutritional effects on yield. Quality is of increasing importance in global markets. The effects of the nutrients, sulphur, copper, chlorine, and nitrogen on quality and disease incidence need to be investigated.

14. Ontario Cereal Crop Committee

Variable Rate Technology

Details: The potential of site specific crop management and variable rate technology is tremendous. These investigations need to continue. This committee requests support of these efforts by the soil management sections within the OASCC system.

Recommendation 3

Issue / Strategic Direction: Plant and crop physiology

Sources: All sub-committees, Ontario Field Crop Research Coalition

OASCC Linkages: OHCRSC

Target Agencies: ARIO, AAFC, CARC

The research conducted and required within this strategic direction tends to be discovery and basic in nature. It covers a number of objectives designed to understand how a plant works, to identify important chemical pathways, genes, and traits. This direction reflects the absolute need for basic research to advance the science of crop production. Basic research in plant and crop physiology provides knowledge that opens new areas of applied science. It is important however, that this basic research be in a conceptual framework of leading to a useful application. Not just science for science sake, but science to understand and improve crop production.

1. Ontario Corn Committee, Ontario Forage Crops Committee

Feed Quality Parameters for Grain Corn and Corn Silage

Approximately, seventy-five percent of the corn produced in Ontario is fed to livestock or poultry, either as grain or as whole plant silage. Thus, the ultimate value of corn is determined by efficiency with which corn is converted to meat and other livestock products relative to other sources of feed. Corn serves primarily as a source of energy, yet relatively little is known about the effect of the forms of energy that are being bred into corn lines (e.g. the different forms of starch; high-oil; etc.) on the performance of different species and classes of livestock and poultry. A multi-disciplinary program is needed to:

1) Design and conduct feeding and laboratory trials, as appropriate, to investigate the relative importance of nutritional and physical characteristics, both natural and *value-added, of grain corn and corn silage for animal performance.

2) Characterize grain corn hybrids relative to important traits identified above.
3) Develop economical analytical methods for these traits to assist in ration balancing.

4) Breed lines of corn with superior yield and feeding value.

This work is envisioned as a co-operative program among corn breeders, cereal chemists, and animal nutritionists, in both the private and public sectors, and producer groups, using existing facilities. Funding would be required to provide overall co-ordination for the program as well as to support the component projects.

2. Ontario Oil and Protein Seed Crop Committee

BREEDING FOR NEW OR MODIFIED OIL AND PROTEIN TRAITS FOR SPECIFIC FOOD, FEED AND INDUSTRIAL USES IN AGRONOMICALLY ACCEPTABLE VARIETIES IN SOYBEANS

Details:

A ***Oil modifications:***

1. Food Use

a) Increase palmitic and/or stearic acids (16-18%) to improve crystalline structure and use in solid fat applications

b) Reduce level of saturated fats (< 6%) to reduce negative health effects

c) Increase oleic (while lowering saturated and /or polyunsaturated fats to increase oxidate stability

2 Industrial Use

d) Increase linolenic acid (>55%) to replace linseed oil as a drying oil in the manufacture of paints and coatings

e) Add exotic fatty acids [recinoleic (>85%) and lauric acid (>50%)] to soybean to increase use in the manufacture of lubricating oil and other industrial products

B ***Protein/Carbohydrate Modifications*:**

1 Food Use

a) Reduce content of fermentable carbohydrates to reduce intestinal discomfort and flatulence

b) Increase content of fermentable carbohydrates (sucrose, glucose, fructose) and increase the use of soybeans in the manufacture of soyfoods (miso, natto, tempeh)

c) Reduce lipoxygenase enzymes to reduce the beany or off-flavour
d) Reduce phenolics and flavonoids to reduce astringency and bitterness

2 Feed Use

a) Increase the content of soybean protein to increase value of soybean meal as a high protein feed supplement.

b) Increase content of essential amino acids (methionine and cysteine)

c) Increase lysine content to reduce the concentration of crude protein in the diets of poultry and swine

d) Reduce protease inhibitor activity by 80% to improve the digestion of proteins and reduce pancreatic hypertrophy

e) Reduce phytate to improve the availability of minerals protein solubility

f) Reduce goitrogens to reduce the risk of goiter

Background: Soybean oil and protein are used in the manufacture of human food, animal feed, and various industrial products. Soybean oil dominates the domestic and world vegetable oil markets. The oil contains saturated [palmitic (11%), stearic (4%)], monounsaturated [oleic (25%)], and ploy unsaturated [linoleic (50%), linolenic (9%)] fatty acids. Because of its fatty acid profile, the oil is used primarily as a salad and cooking oil and as a fat in the production of shortening and margarine. Only 2% of all soybean oil produced is used in industry. Specific genetic modifications can be made to improve oil content, quality and stability. These modifications can educe processing costs and increase the marketability and value ($.08 to $3 US /bushel) of soybeans (Iowa Agriculture & Home Economics Experiment Station Special Report 92)

Soybean protein constitutes about 46% of soybean meal and is used as an ingredient in animal feed, human food, and industrial products. About 95% of soybean meal is used to supply protein in livestock (poultry, swine, cattle) feeds. For use in food and products and industrial products, soybean meal is processed into various edible protein ingredients, including flour, concentrates, isolates. Most edible protein products are used to replace the use of animal and dairy proteins in foods for human consumption. Industry uses soybean protein primarily in the manufacture of paper coatings. Improving the content and quality of soybean protein can add $.06 to $.46 (US) to each bushel of soybean (Iowa Agriculture & Home Economics Experiment Station Special Report 92) and increase the nutrition, energy density, and marketability of soybean meal.

Soybean produced in Ontario must compete in the international marketplace with soybean and other oilseeds produced throughout the world. To maintain a share of the specialty oilseed market, each Ontario soybean variety must possess traits that provide added-value and a unique identity. Using current technologies (chemical mutagenesis, biotechnology, and breeding) oil and protein modifications can be made to add value and improve the marketability of soybean varieties developed in Ontario.

3. Ontario Oil and Protein Seed Crop Committee

IMPROVED UTILIZATION OF NUTRIENTS (N2 FIXATION) IN SOYBEANS

Details: Improve the efficiency of nitrogen fixation and nitrogen utilization by the following methods:

1. Evaluate inoculant products to advise growers which ones to use n new soybean land.
2. Test strains to identify the most efficient.
3. Develop methods for changing strains of soybean rhizobia in growers fields.
4. Increase soybean yields by devising novel methods to get more total N into the crop.
5. Determine whether other micro-organisms can enhance soybean yields or improve the efficiency of fertilizer use.

Background: The yield of soybean is N-limited. Accumulated N comes from soil available N or from N2 fixation. Increasing the rates of fertilization N applied to soybeans, however, inhibits nodule formation, nodule mass, and N2 fixation and also results in a reduced proportion of the total plant N accumulating in the seed. Increases in N2 fixation, on the other hand, cause substantial yield increases. A strain of soybean rhizobia called 532C was identified at Guelph in the mid-1980's. This strain fixed more N2 than previous strains under the same conditions. Strain 532C increased soybean yields by 7 to 9 % each year. When 532C was introduced into new soybean soil, it persisted and maintained its efficiency. This strain now occupies about 15% of the soybean acreage in Ontario. If it increases yields by 8% on the 15% of the acreage and the Ontario soybean crop is worth $500 million per year, strain 532C increases the value of the Ontario soybean crop by $6 million annually with no added inputs. Its value also continues to rise as new acres are inoculated with this more efficient strain.

Over the past 4 years, detailed studies have been conducted on why recently-released soybean varieties outyield older varieties when they are planted in the same field. Surprisingly, one of the answers is that newer soybeans are much more efficient at accumulating available soil N without decreasing their N2 fixation. These results suggest that one of the keys to higher soybean yields is to understand how to manipulate available soil N while maintaining N2 fixation.

Recommendation 4

Issue / Strategic Direction: Variety / Pesticide Testing

Source: All subcommittees, Ontario Field Crop Research Coalition

OASCC Linkages: none

Target Agencies: ARIO, OMAFRA, AAFC

This strategic direction combines both research and service components. Clearly proper scientific methodologies must be applied in variety testing, but the end result of this research is primarily a service to producers and to the industry. In Ontario, variety testing comprises two components that are somewhat distinct and serve different functions. The first is registration testing. This testing provides data to support new varieties for registration (legal right to sell and produce seed by variety name) and depending upon the committee may be used as performance data. Performance testing is that testing which producers use to make variety choices. Over the last 18 months the Canadian Food Inspection Agency has conducted a review of registration testing and broad changes may be implemented in 2002. This will affect how this service component is conducted but in no way diminished its importance. In fact, as the requirements for registration are reduced or eliminated, the need for a strong and effective performance testing system becomes greater and there is wide-spread support for performance testing among producers and the industry. The current system for registration testing is essentially 100% cost recovery in all crops while most performance testing systems are partnerships among the University of Guelph, the regional Colleges, AAFC, industry and producers. A very strong performance testing system is important, as wrong decisions on variety/hybrid choice are costly. Obviously the potential for economic loss could be extremely high and this underpins the requirement for solid and reliable performance data for producers.

1. Ontario Cereal Crops Committee

Assessment of Performance Testing Systems

Background: Producers base most of their variety decisions on information they receive from provincial performance data, along with company information and their own experience. With the move to fiscal restraint, the level of performance testing has been greatly curtailed within the cereal crop sector. The impact this will have on the validity of the data presented to the farmer is unknown.

Concurrently to this reduction of testing, other sources of information are becoming available from farmer strip trials and combine yield monitors. Again, the validity of this data is unknown.

An investigation of this data, and a determination of what is required to have valid information to

give the producer, is essential. The committee suggests that Guelph undertake this project, and enlist help from whatever other sources are required.

Economic Importance: Selecting the proper variety is the number one factor in grower profitability. Selecting an inferior variety, with as little yield differential as 2 bu./ac., would cost the Ontario producer 7 million dollars across the province.

2. Ontario Forage Crops Committee

CONTINUE AND IMPROVE THE PUBLIC SYSTEM OF FORAGE VARIETY TESTING IN COOPERATION WITH INDUSTRY STAKEHOLDERS.

Directed to: ARIO and OMAFRA

Background: The OFCC has been conducting unbiased evaluation of varieties for yield and persistence since the committee was established in 1956. The work was undertaken to: i) Identify the varieties which merit use by forage producers in Ontario ii) Provide relative performance information among forage varieties available in the marketplace, and iii) Provide data to Canadian Food Inspection Agency to allow the legal sale of these varieties. In 1991, the OFCC was the first provincial recommending committee to undertake quality evaluation of forage varieties in addition to yield performance.

Forage yields and quality samples are collected from OFCC registration trials at public testing centres. The OFCC worked with the Seed Trade and the Canadian Food Inspection Agency during 1997 to improve the system of support for variety registration. This will allow varieties that meet OFCC performance criteria to be supported for registration using some or all data from outside Ontario. This will allow producers to have access to these varieties 2 years earlier than under the previous system. The OFCC still conducts performance testing and still provides performance data from public trials in Ontario to producers as in the past.

A significant change could occur over the next year as the CFIA has proposed that merit-based registration be eliminated for all forage crop species. This could significantly affect the performance testing system since new varieties would no longer have a legal requirement to be tested in public Ontario tests. The OFCC is working out strategies to deal with this eventuality and is seeking views from other stakeholders as to how the performance testing system might be continued.

The OFCC recommends that variety testing for yield, persistence, and quality be continued.

Service Priorities

Issue/Strategic Direction: Research Verification

Source: All Committees, Ontario Field Crop Research Coalition

OASCC Linkages: All committees

Targeted Agencies: OMAFRA, AAFC

It is important that the products of research are used by the clients that need it, otherwise the research itself is meaningless. In the field crop sector the results of research are disseminated in a wide variety of ways from publications, meetings, web-sites, and by interactions of all kinds. The clearer and the more understandable the outcomes of research can be made, the greater will be the proper uptake and utilization. A number of success stories in technology transfer are being documented. The new Ontario Soil and Crop Improvement Association web-site with variety performance information for corn, soybeans and wheat has tremendous potential as a tool to work in concert with the Ontario Performance Trials in those crops to assist growers with their variety choices. The lead positions created by OMAFRA are making an impact in Ontario and the team approach between research and extension fostered by the OASCC committees should be encouraged.

1. Ontario Forage Crops Committee

EXTENSION OF EXISTING AND NEW RESEARCH RESULTS ON FORAGE CROP GENETIC IMPROVEMENTS, AND PRODUCTION AND MANAGEMENT METHODS.

Directed to: OMAFRA

Background: Forages are a very diverse crop, encompassing many species, harvest methods, and storage and feeding systems. Forage producers, with the exception of cash crop hay producers, generally regard themselves as livestock producers rather than forage producers. Because of this, a strong effort in extending forage-related information to producers is needed. Surveys done by the Ontario Forage Council have indicated that producers desire forage extension information to be straightforward, concise, and without excessive technical jargon. In addition to extending the direct research results, producers seek some level of analysis or interpretation of research results to clearly outline the alternatives that are presented by a given research project. Recently, there has also been a demand for more information on corn silage production and management options which could also be delivered by forage extension staff.

The OFCC recommends that existing extension efforts directed to forages crops, including corn silage, be strengthened. It is recognized that regional crop specialists with a forage mandate are in place, but it is suggested that they be given a higher profile and a larger portion of their time and resources directed to forage crop extension.

Strategic Directions and Resource Shifts

The above strategic directions represent research and service activities currently underway and funded by a wide-range of public and private funding sources. These directions, based on the mandate of the Ontario Field Crop Research and Services Committee, are the areas of greatest need and impact and they have wide industry support. In the section on Sector scans, each commodity area identified a number of issues facing their committees and the commodities that they represent. It is in these areas that those responsible for resource reallocation should look. For example, a considerable effort over the last several years has been focused on Fusarium in corn and wheat. And there have been success – identification of hybrids with some tolerance, the registration of Folicur , a fungicide for control of Fusarium in wheat and the introduction of a weather-based disease incidence model delivered via the Internet through the Ontario Weather Network. However, the screening test for Fusarium appears at best to be erratic and if significant improvement in breeding for rst./tolerance is to be made, a simple, reliable and repeatable test is required. Again, 2000 was a year in which the organism caused very significant losses this time through secondary infection in wheat and over the last decade significant losses in both corn and cereals have occurred with frequent regularity. There is considerable research effort attacking this problem from a number of fronts and it is a top priority in both the public research efforts and the industry. It is clear that more work is needed in this area.

Both the Forage committee and the Corn committee have noted that corn silage as a feed source has changed with the introduction of new hybrids with greater digestibility and feed value. There has been some preliminary work done with feeding trials using these new silage hybrids and the results have been very encouraging. There is renewed interest in corn silage among growers, but the information on agronomic performance and animal utilization is scant. This area has the potential to allow for significant increases in productivity and efficiency.

Many of Ontario's field crops have tremendous potential for premium-based niche production opportunities. Success in this area with soybeans provides Ontario with some experience and infrastructure-based advantages. There appear to be a number of opportunities for wheat in Ontario to meet changing market demands, but the entire industry needs to collaborate on any shifts to ensure that the required processing traits can be consistently meet. There have been some encouraging and initial successes with food-grade corn specifically the production and processing of white corn in Ontario. This research has been primarily "soft-funded" and the potential for a new industry from a grower perspective warrants consideration of base-funding shifts to continue these efforts. The production of new market classes of coloured beans and the development of export markets also provides a potential new opportunity for Ontario. We can successfully grow a number of coloured bean types quite well and further diversification in this area is being promoted by the industry. Clearly issues of quality are becoming increasingly important in the edible bean sector, particularly, but not exclusively in white beans, where competition from Western Canada, particularly Manitoba is intense.

The recent changes within the OASCC structure has provided both challenges and opportunities. Within the Field Crop Committee, weed and pest management issues and priorities were highlighted at the Dec. 2000 meeting and were successfully integrated within this report. Further based on the nature of the mandates, it is inevitable that there will be some overlap in research and service priorities between the Ontario Soil, Water and Air Research and Services Committee (OSWARSC) and the Ontario Field Crops Research and Services Committee (OFCRSC). The

Chair of OSWARSC attended the OFCRSC meeting in December and proposed increasing communications as the most appropriate mechanism to avoid any potential duplication of effort. A suggestion was made that formal cross-liaison positions be established and reviewed after one-year. There will be a liaison from OSWARSC to OFCRSC and from OFCRSC to OSWARSC.

Industry is represented on the OFCRSC in several ways including three official representatives from the Ontario Field Crop Research Coalition. The Coalition is comprised of essentially all field crop commodity organizations and associations. At the December meeting of OFCRSC this organization brought forward a number of issues including

6. commitment from OMAFRA to stable, long-term funding for agricultural research – additional cuts are not acceptable to the industry.
7. OMAFRA should increase its allocation of resources to increase extension services. Uncertainty was expressed on the future of the Canada-Ontario Research and Development Program (CORD). If new funding is not secured, the research community will see a significant reduction in the amount of funding allocated by Ontario commodity organizations.
- Concern was expressed that the MII budget for AAFC 2000/01 will only be $ 30 million – a 14% reduction from previous years

In addition the OFCRC remains extremely committed to an active role in the OASCC system. Several working groups were established in 2000. These include Pest Management WG, Soil Fertility, Greenhouse Gases and Tillage/Cropping Systems WG which have already provide detailed research priorities to the appropriate OASCC sub-committees and new committees being formed as Crop Quality/ Specific Market Opportunities WG, Genetic Improvement WG and the Field Crop Variety Performance WG.

Appendices:

Appendix 1. Industry - Funded Tobacco Research Priorities

The following list (descending order) of research priorities was identified by the tobacco production and protection practices sub-committee.

1- Fungicide screening for blue mold

2- Development of resistant cultivars to diseases such as black root rot and blue mold and to insects such as aphids using both conventional and non-conventional approaches.

3- Evaluate the effects of a forage millet and tobacco rotation on soil nematode populations and tobacco yield and quality.

4- Evaluate the sucker control methods - improved efficiency/lower rate application

5- Development of control measures for bacterial soft rot

6- Fungicide screening for Target Spot/Damping Off

7- Further develop the float tray system for producing seedlings in Ontario with emphasis on 1) determining methods to dispose of spent float water in an environmentally friendly manner, 2) determining pest management strategies and 3) evaluating the applicability of the ebb and flow method.

8- Evaluate the efficacy of direct measurement of weight loss as a curing control technique

9- Influence of field cultural practices on leaf yield and quality

10- Identify the cause(s) and solutions(s) of tobacco bruising

11- Control of storage mold (*Apergillius*)

12- Develop measures to reduce TSNA=s in cured tobacco

13- Develop control measures for Wireworm and seed maggot.

Appendix 2: Report of Action Taken on Previous Recommendations

ARIO RESPONSE TO:

ONTARIO FIELD CROPS RESEARCH AND SERVICES COMMITTEE (OFCRSC) 1999 REPORT

Response:

The ARIO recognizes the priorities for research that have been identified by the Field Crops Research and Services Committee and its subcommittees. The four main research priorities of field crop breeding and biotechnology, agronomic technologies, plant and crop physiology and variety testing are being addressed within the Plants program at the University of Guelph. Research to address field crop priorities is also supported through programs such as FS2002 and the Special Research Fund

The resources available to support research dictate that not all priorities can be addressed simultaneously. In order for new priorities to be addressed, or emphasis shifted, existing research must be scaled back or completed so that resources can be reallocated. Committees can assist in this process by continuing to identify areas which are the highest priority and also which areas of research which can be reduced.

The ARIO recognizes that many of the field crop priorities identified are related to pest management . In light of changes to the Pest Management Research and Services Committee (OPMRSC), it will be increasingly important in the future that the Field Crops Research and Services Committee and subcommittees consider pest management issues and communicate directly with the OPMRSC.

The Plants program at the University of Guelph will be reviewed by ARIO in two years time. In preparation for that review we would encourage the committee to consider how the research priorities from the individual commodity subcommittees can be incorporated into a strategic report for the field crops industry.

Appendix 3. **Summary of Distribution of Recommendations**

SUMMARY OF DISTRIBUTION OF RECOMMENDATIONS

	Recommendation	AAFC	ARIO	CARC	OMAFRA	OTHER
1	Field Crop Breeding & Biotech	✔	✔	✔		OPMRSC
2	Agronomic Technologies		✔	✔	✔	OSWARC
3	Plant & Crop Physiology	✔	✔	✔		
4.	Variety / Pesticide Testing Service		✔	✔		✔
1.	Research Verification	✔			✔	

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